UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2

In The Matter Of:	)	
	)	
HIGGINS DISPOSAL SUPERFUND SITE	)	
	)	
FMC CORPORATION,	)	
Respondent	)	
	)	
	)	U.S. EPA
	)	Docket No.CERCLA-02-2003-2034
	)	
	)	
Proceeding Under Section 106(a) of the	)	
Comprehensive Environmental Response,	)	
Compensation, and Liability Act of 1980,	)	
as amended (42 U.S.C. 9606(a))	)	

ADMINISTRATIVE ORDER FOR REMEDIAL DESIGN AND REMEDIAL ACTION

I. INTRODUCTION AND JURISDICTION

1. This Administrative Order ("Order") directs the FMC Corporation ("Respondent") to design and implement the remedial action selected in the Record of Decision issued by the United States Environmental Protection Agency ("EPA") on September 30, 1997 and as further described in the Explanation of Significant Differences for the Higgins Disposal Superfund Site (the "Site"), dated December 9, 2002. This Order is issued to Respondent by the EPA under the authority vested in the President of the United States by section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. 9606(a). This authority was delegated to the Administrator of EPA on January 23, 1987, by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and was further delegated to EPA Regional Administrators on September 13, 1987 by EPA Delegation No. 14-14-B.

II. DEFINITIONS

2. Unless otherwise expressly provided herein, terms used in this Order which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in the statute or its implementing regulations. Whenever terms listed below are used in this Order or in the documents attached to this Order or incorporated by reference into this Order, the following definitions shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq.

b. "Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the end of the next working day.

c. "EPA" shall mean the United States Environmental Protection Agency.

d. "Explanation of Significant Differences"shall mean the Explanation of Significant Differences relating to the Site issued on December 9, 2002 by the Regional Administrator, EPA Region 2, and all attachments thereto. The Explanation of Significant Differences is appended as Attachment 2 to this Order and is fully enforceable as a part of this Order.

e. "National Contingency Plan" shall mean the National Contingency Plan promulgated pursuant to section 105 of CERCLA, 42 U.S.C. 9605, codified at 40 C.F.R. Part 300, including any amendments thereto.

f. "NJDEP" shall mean the New Jersey Department of Environmental Protection.

g. "Operation and Maintenance" shall mean all activities required under the Operation and Maintenance Plan developed by Respondent pursuant to this Order and he Statement of Work, and approved by EPA.

h. "Paragraph" shall mean a portion of this Order identified by an Arabic numeral.

i. "Performance Standards" shall mean those cleanup standards, standards of control, and other substantive requirements, criteria or limitations, identified in the Record of Decision, Explanation of Significant Differences, and Statement of Work, that the Remedial Action and Work required by this Order must attain and maintain.

j. "Record of Decision" shall mean the Record of Decision relating to the Site signed on September 30, 1997 by the Regional Administrator, EPA Region 2, and all attachments thereto. The Record of Decision is appended as Attachment 1 to this Order and is fully enforceable as a part of this Order.

k. "Remedial Action" shall mean those activities, except for Operation and Maintenance, to be undertaken by Respondent to implement the final plans and specifications submitted by Respondent pursuant to the Remedial Design Work Plan approved by EPA, including any additional activities required under Sections X, XI, XII, XIII, XIV, and XV of this Order.

l. "Remedial Design" or shall mean those activities to be undertaken by Respondent to develop the final plans and specifications for the Remedial Action pursuant to the Remedial Design Work Plan.

m. "Statement of Work" shall mean the statement of work for implementation of the

Remedial Design, Remedial Action, and Operation and Maintenance at the Site, as set forth in Attachment 3 to this Order. The Statement of Work is appended to this Order as Attachment 3 and is incorporated into this Order and is an enforceable part of this Order.

n. "Section" shall mean a portion of this Order identified by a Roman numeral and includes one or more paragraphs.

o. "Site" shall mean the Higgins Disposal Superfund site, encompassing approximately 38 acres, located at 121 Laurel Avenue in Kingston, Somerset County, New Jersey, as described in the Record of Decision and Explanation of Significant Differences.

p. "State" shall mean the State of New Jersey.

q. "United States" shall mean the United States of America.

r. "Work" shall mean all activities Respondent is required to perform under this Order, including Remedial Design, Remedial Action, Operation and Maintenance, and all activities required to be undertaken pursuant to Sections VII through XXII, and XXVI of this Order.

III. FINDINGS OF FACT

3. The Higgins Disposal Superfund Site ("Site") is located at 121 Laurel Avenue in Kingston, Franklin Township, Somerset County, New Jersey. The Site consists of approximately 38 acres in a rural residential area. The current owner, Lisbeth Higgins, jointly owned the Site with her husband, Clifford Higgins, Sr., from approximately 1967 until Mr. Higgins's death in November 1997. Mrs. Higgins currently owns and resides on the Site. From the 1950s until 1985, Mr. Higgins operated a waste hauling service at the Site. In addition to the waste hauling operation, at some point Mr. Higgins also began to operate a landfill and transfer station at the Site. Respondent was one of Mr. Higgins's industrial customers.

4. In 1985, the New Jersey Department of Environmental Protection ("NJDEP") and the Franklin Township Health Department found that residential wells on Laurel Avenue were contaminated with volatile organic compounds ("VOCs"), which are CERCLA hazardous substances. Groundwater is a source of potable drinking water for the Site and nearby residents and businesses.

5. On August 20, 1990, pursuant to section 105 of CERCLA, 42 U.S.C. 9605, EPA placed the Site on the National Priorities List, set forth at 40 C.F.R. Part 300, Appendix B.

6. In 1991, EPA began the first of several removal actions at the Site. The first removal involved excavating and removing approximately 765 tons of soil contaminated with polychlorinated biphenyls ("PCBs") from the Site.

7. From approximately October 1992 to August 1996, EPA undertook a Remedial Investigation and Feasibility Study ("RI/FS") for the Site, pursuant to CERCLA and the National Contingency Plan, 40 C.F.R. Part 300. The purpose of the RI/FS was to determine the nature and extent of

contamination at the Site and to evaluate remedial alternatives.

8. The RI investigations revealed the presence of buried laboratory containers and drums in several areas at the Site. Many of the containers were severely corroded or leaking. Soil was visibly contaminated. Waste and soil samples revealed the presence of contaminants such as benzene; xylene; 1,1,2,2-tetrachloroethane; 1,1,1-trichloroethane; 2-chlorophenol; di-n-butyl phthalate; arsenic; mercury; zinc; and lead. Between 1993 and 1997, EPA's removal action branch excavated and removed over 7,000 buried containers and approximately 12,500 tons of contaminated soil from various areas at the Site.

9. The RI investigations revealed that the groundwater beneath the Site was contaminated with hazardous substances such as VOCs, semi-VOCs, pesticides, and metals.

10. The specific contaminants of concern detected in the groundwater at the Site include benzene; carbon tetrachloride; chlorobenzene; chloroform; 1,1-dichloroethene; 1,1,2,2-tetrachloroethane; tetrachloroethene; trichloroethene; vinyl chloride; PCBs; antimony; arsenic; beryllium and manganese.

11. In April 1997, pursuant to section 117 of CERCLA, 42 U.S.C. 9617, EPA published notice of the completion of the RI/FS and of the proposed plan for remedial action. EPA subsequently provided the public with an opportunity for comment on the remedial action EPA proposed for the Site.

12. On September 30, 1997, the EPA issued its decision in a Record of Decision. The Record of Decision selected and described the remedial action required at the Site. The State concurred on the Record of Decision and its contents. The Record of Decision is supported by an administrative record that contains the documents and information upon which EPA based its selection of the response actions. The Record of Decision is attached and is incorporated by reference into this Order.

13. The remedy selected in the Record of Decision had two components: 1) provision of a public water supply to the residents along Laurel Avenue by extension of the existing public water supply line, and 2) installation of on-site extraction wells and a pipeline for the conveyance of the contaminated groundwater to the nearby Higgins Farm Superfund Site groundwater treatment plant for treatment. In 1998, Respondent performed the first component of the Record of Decision remedy, extension of the public water supply line, pursuant to a Unilateral Administrative Order, Index No. II-CERCLA-98-0107. In 1998, Respondent also excavated and removed contaminated soil and thousands of containers from an on-site landfill pursuant to Administrative Order on Consent, Index. No. II CERCLA-98-0104.

14. Based upon new information obtained by EPA after the Record of Decision was issued, EPA issued an Explanation of Significant Differences on December 9, 2002. The State had a reasonable opportunity to review and comment on the Explanation of Significant Differences. The Explanation of Significant Differences documented EPA's decision to extract, treat and re-inject contaminated groundwater on the Site instead of conveying the contaminated groundwater to the Higgins Farm Superfund Site for treatment and subsequent discharge. The Explanation of

Significant Differences is supported by an administrative record that contains the documents and information upon which EPA based the changes made to the remedy. The Explanation of Significant Differences is attached and is incorporated by reference into this Order.

15. Many residents in the vicinity of the Site, as well as the residents on the Site, depend on groundwater as their potable water source. Exposure to the contaminated groundwater could pose a threat to any present and future residents who use the groundwater as a potable water source. Although a public water supply line was extended and connected to residences on Laurel Avenue, there remains the potential for contaminated groundwater to migrate to other residential wells. Approximately 10,000 people rely on groundwater as a source of drinking water within a three mile radius of the Site.

16. Implementation of this Order will provide capture and treatment of contaminated groundwater through the construction of an on-site groundwater extraction, treatment and re-injection system. An extraction well will capture contaminated groundwater, which will be piped to a treatment plant. The treated water will be re-injected into the aquifer.

IV. CONCLUSIONS OF LAW AND DETERMINATIONS

17. The Higgins Disposal Superfund Site is a "facility" as defined in section 101(9) of CERCLA, 42 U.S.C. 9601(9).

18. Respondent is a "person" as defined in section 101(21) of CERCLA, 42 U.S.C. 9601(21).

19. A. Respondent arranged, by contract or agreement, or otherwise, or arranged with a transporter for transport for disposal or treatment of hazardous substances owned or possessed by Respondent. Hazardous substances of the same kind as those owned or possessed by Respondent were present at the Site.

B. Respondent accepted hazardous substances for transport to, and disposal or treatment at the Site, and selected the Site for disposal or treatment.

20. Respondent is a "liable party" under one or more subsections of section 107(a) of CERCLA, 42 U.S.C. 9607(a), and is subject to this Order under section 106(a) of CERCLA, 42 U.S.C. 9606(a).

21. The substances listed in paragraph 10 which exist in groundwater at the Site are "hazardous substances" as defined in section 101(14) of CERCLA, 42 U.S.C. 9601(14).

22. These hazardous substances have been, are being and threaten to be released from the Site into the groundwater beneath the Site.

23. The past disposal and migration of hazardous substances from the Site are a "release" as that term is defined in section 101(22) of CERCLA, 42 U.S.C. 9601(22).

24. The potential for future migration of hazardous substances from the Site poses a threat of a

"release" as that term is defined in section 101(22) of CERCLA, 42 U.S.C. 9601(22).

25. The release and threat of release of one or more hazardous substances from the Site may present an imminent and substantial endangerment to the public health or welfare or the environment.

26. The contamination and endangerment at this Site constitute an indivisible injury. The actions required by this Order are necessary to protect the public health, welfare, and the environment.

V. NOTICE TO THE STATE

27. On August 29, 2003, prior to issuing this Order, EPA notified the State of New Jersey, Department of Environmental Protection, that EPA would be issuing this Order.

VI. ORDER

28. Based on the foregoing, Respondent is hereby ordered to comply with the following provisions, including but not limited to all attachments to this Order, all documents incorporated by reference into this Order, and all schedules and deadlines in this Order, attached to this Order, or incorporated by reference into this Order:

VII. NOTICE OF INTENT TO COMPLY

29. Respondent shall provide, not later than five (5) days after the effective date of this Order, written notice to EPA's Remedial Project Manager ("RPM") stating whether it will comply with the terms of this Order. If Respondent does not unequivocally commit to perform the Remedial Design and Remedial Action as provided by this Order, it shall be deemed to have violated this Order and to have failed or refused to comply with this Order. Respondent's written notice shall describe, using facts that exist on or prior to the effective date of this Order, any "sufficient cause" defenses asserted by Respondent under sections 106(b) and 107(c)(3) of CERCLA. The absence of a response by EPA to the notice required by this paragraph shall not be deemed to be acceptance of Respondent's assertions.

VIII. PARTIES BOUND

30. This Order shall apply to and be binding upon the Respondent, its directors, officers, employees, agents, successors, and assigns. No change in the ownership, corporate status, or other control of Respondent shall alter any of the Respondent's responsibilities under this Order.

31. Respondent shall provide a copy of this Order to any prospective owners or successors before a controlling interest in Respondent's assets, property rights, or stock are transferred to the prospective owner or successor. Respondent shall provide a copy of this Order to each contractor, sub-contractor, laboratory, or consultant retained to perform any Work under this Order, within five days after the effective date of this Order or on the date such services are retained, whichever date occurs later. Respondent shall also provide a copy of this Order to each

person representing any Respondent with respect to the Site or the Work and shall condition all contracts and subcontracts entered into hereunder upon performance of the Work in conformity with the terms of this Order. With regard to the activities undertaken pursuant to this Order, each contractor and subcontractor shall be deemed to be related by contract to the Respondent within the meaning of section 107(b)(3) of CERCLA, 42 U.S.C. 9607(b)(3). Notwithstanding the terms of any contract, Respondent is responsible for compliance with this Order and for ensuring that its contractors, subcontractors and agents comply with this Order, and perform any Work in accordance with this Order.

IX. WORK TO BE PERFORMED

32. Respondent shall give EPA fourteen (14) days advance notice of all field activities to be performed pursuant to this Order.

33. Respondent shall cooperate with EPA in providing information regarding the Work to the public. As requested by EPA, Respondent shall participate in the preparation of such information for distribution to the public and in public meetings which may be held or sponsored by EPA to explain activities at or relating to the Site.

34. Respondent shall implement the Statement of Work found at Attachment 3 to this Order, and incorporated herein by reference. The Work to be performed by Respondent pursuant to this Order shall, at a minimum, achieve the requirements of the Performance Standards specified in the Record of Decision, the Explanation of Significant Differences, and in Section II of the Statement of Work. All work required by this Order shall be performed in a manner consistent with this Order and all applicable laws. Nothing in this Order or the plans or other documents required to be submitted pursuant to this Order or EPA's approval of those plans or other documents, constitutes a warranty or representation of any kind by EPA that compliance with those plans and this Order will achieve the requirements of the Performance Standards specified in the Record of Decision, the Explanation of Significant Differences, and in Section II of the Statement of Work, and does not foreclose EPA from seeking additional work to achieve the applicable performance standards.

35. Upon approval by EPA, all work plans set forth in the Statement of Work are incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order.

36. Respondent shall, prior to any off-site shipment of hazardous substances from the Site to an out-of-state waste management facility, provide written notification to the appropriate state environmental official in the receiving state and to EPA's Remedial Project Manager of such shipment of hazardous substances. However, the notification of shipments shall not apply to any off-Site shipments when the total volume of all shipments from the Site to the State will not exceed ten (10) cubic yards.

a. The notification shall be in writing, and shall include the following information, where available: (1) the name and location of the facility to which the hazardous substances are to be shipped; (2) the type and quantity of the hazardous substances to be shipped; (3) the expected schedule for the shipment of the hazardous substances; and (4) the method of transportation.

Respondent shall notify the receiving state of major changes in the shipment plan, such as a decision to ship the hazardous substances to another facility within the same state, or to a facility in another state.

b. The identity of the receiving facility and state will be determined by Respondent following the award of the contract for Remedial Action construction. Respondent shall provide all relevant information, including information under the categories noted in paragraph 36.a above, on the off-Site shipments as soon as practicable after the award of the contract and before the hazardous substances are actually shipped.

X. FAILURE TO ATTAIN PERFORMANCE STANDARDS

37. In the event that EPA determines that additional response activities are necessary to meet applicable Performance Standards, EPA may notify Respondent that additional response actions are necessary pursuant to Section XII of the Statement of Work.

XI. EPA PERIODIC REVIEW

38. Under section 121(c) of CERCLA, 42 U.S.C. 9621(c), and any applicable regulations, EPA may review the Site to assure that the Work performed pursuant to this Order adequately protects human health and the environment. Until such time as EPA certifies completion of the Work, Respondent shall conduct the requisite studies, investigations, or other response actions as determined necessary by EPA in order to permit EPA to conduct the review under section 121(c) of CERCLA. As a result of any review performed under this paragraph, Respondent may be required to perform additional work or to modify work previously performed.

XII. ADDITIONAL RESPONSE ACTIONS

39. EPA may determine that in addition to the work identified in this Order and attachments to this Order, additional response activities may be necessary to protect human health and the environment. If EPA determines that additional response activities are necessary, EPA may require Respondent to submit a work plan for additional response activities. EPA may also require Respondent to modify any plan, design, or other deliverable required by this Order, including any approved modifications.

40. Not later than thirty (30) days after receiving EPA's notice that additional response activities are required pursuant to this Section, Respondent shall submit a work plan for the response activities to EPA for review and approval. Upon approval by EPA, the work plan is incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order. Upon approval of the work plan by EPA, Respondent shall implement the work plan according to the standards, specifications, and schedule in the approved work plan. Respondent shall notify EPA of their intent to perform such additional response activities within seven (7) days after receipt of EPA's request for additional response activities.

XIII. ENDANGERMENT AND EMERGENCY RESPONSE

41. In the event of any action or occurrence during the performance of the work which causes or threatens to cause a release of a hazardous substance or which may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action to prevent, abate, or minimize the threat, and shall immediately notify EPA's Remedial Project Manager (RPM). If the EPA RPM is unavailable, Respondent shall notify the EPA Regional Duty Officer at (732) 548-8730, the EPA Regional Emergency 24-hour telephone number, of the incident or site conditions. Respondent shall take such action in consultation with EPA's RPM or other available authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plans and the Contingency Plans, and any other applicable plans or documents developed pursuant to this Order and Statement of Work.

42. Nothing in the preceding paragraph shall be deemed to limit any authority of the United States to take, direct, or order all appropriate action to protect human health and the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substance on, at, or from the Site.

XIV. EPA REVIEW OF SUBMISSIONS

43. After review of any deliverable, plan, report or other item which is required to be submitted for review and approval pursuant to this Order, EPA may: (a) approve the submission; (b) approve the submission with modifications; (c) disapprove the submission and direct Respondent to re-submit the document after incorporating EPA's comments; or (d) disapprove the submission and assume responsibility for performing all of any part of the response action. As used in this Order, the terms "approval by EPA," "EPA approval," or a similar term means the action described in paragraph (a) or (b) of this paragraph.

44. In the event of approval or approval with modifications by EPA, Respondent shall proceed to take any action required by the plan, report, or other item, as approved or modified by EPA.

45. Upon receipt of a notice of disapproval or a request for a modification, Respondent shall, within twenty-one (21) days or such longer time as specified by EPA in its notice of disapproval or request for modification, correct the deficiencies and resubmit the plan, report, or other item for approval. Notwithstanding the notice of disapproval, or approval with modifications, Respondent shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of the submission.

46. If any submission is not approved by EPA, Respondent shall be deemed to be in violation of this Order.

XV. PROGRESS REPORTS

47. In addition to the other deliverables set forth in this Order, Respondent shall provide monthly progress reports to EPA with respect to actions and activities undertaken pursuant to this Order. The progress reports shall be submitted on or before the last day of each month following the effective date of this Order. Respondent's obligation to submit progress reports continues until EPA gives Respondent written notice under Section XVI of the Statement

of Work. At a minimum these progress reports shall: (1) describe the actions which have been taken to comply with this Order during the prior month; (2) include all results of sampling and tests and all other data received by Respondent and not previously submitted to EPA; (3) describe all work planned for the next month with schedules relating such work to the overall project schedule for Remedial Design/Remedial Action completion; and (4) describe all problems encountered and any anticipated problems, and actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

XVI. QUALITY ASSURANCE, SAMPLING AND DATA ANALYSIS

48. Respondent shall use the quality assurance, quality control, and chain of custody procedures described in the "EPA Requirements for Quality Assurance Project Plans (QA/R-5)" (EPA 240/B-01/003, March 2001) and "Guidance for Quality Assurance Project Plans (QA/R-5)" (EPA 600/R-98/018, February 1998), and any amendments to these documents while conducting all sample collection and analysis activities required herein by any plan. To provide quality assurance and maintain quality control, Respondent shall:

a. Use only laboratories which have a documented quality system that complies with ANSI/ASQC E-4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (American National Standard, January 5, 1995) and "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program (NELAP) to meet the quality system requirements.

b. Ensure that the laboratories used by Respondent for analyses, performs according to a method or methods deemed satisfactory to EPA and submits all protocols to be used for analyses to EPA at least fourteen (14) days before beginning analysis.

c. Ensure that EPA personnel and EPA's authorized representatives are allowed access to the laboratory and personnel utilized by the Respondent(s) for analyses.

49. Respondent shall notify EPA not less than fourteen (14) days in advance of any sample collection activity. At the request of EPA, Respondent shall allow split or duplicate samples to be taken by EPA or its authorized representatives, of any samples collected by Respondent with regard to the Site or pursuant to the implementation of this Order. In addition, EPA shall have the right to take any additional samples that EPA deems necessary.

XVII. COMPLIANCE WITH APPLICABLE LAWS

50. All activities by Respondent pursuant to this Order shall be performed in accordance with the requirements of all Federal and state laws and regulations. EPA has determined that the activities contemplated by this Order are consistent with the National Contingency Plan.

51. Except as provided in section 121(e) of CERCLA and the National Contingency Plan, no permit shall be required for any portion of the Work conducted entirely on-Site. Where any

portion of the Work requires a Federal or state permit or approval, Respondent shall submit timely applications and take all other actions necessary to obtain and to comply with all such permits or approvals.

52. This Order is not, and shall not be construed to be, a permit issued pursuant to any Federal or state statute or regulation.

53. All materials removed from the Site shall be disposed of or treated at a facility approved by EPA's RPM and in accordance with section 121(d)(3) of CERCLA, 42 U.S.C. 9621(d)(3); with the U.S. EPA "Revised Off-Site policy," OSWER Directive 9834.11, November 13, 1987; and with all other applicable Federal, state, and local requirements, including but not limited to EPA "off-site" regulations published on Sept. 22, 1993, 58 FR 49200, 49201.

XVIII. REMEDIAL PROJECT MANAGER

54. All communications, whether written or oral, from Respondent to EPA shall be directed to EPA's Remedial Project Manager or Alternate Remedial Project Manager. Respondent shall submit to EPA two copies of all documents, including plans, reports, and other correspondence, which are developed pursuant to this Order, and shall send these documents by certified mail, return receipt requested.

EPA's Remedial Project Manager is:

Michael Zeolla
U.S. Environmental Protection Agency
Emergency and Remedial Response Division
290Broadway
New York, New York 10007-1866
(212) 637-4376

55. EPA has the unreviewable right to change its Remedial Project Manager. If EPA changes its Remedial Project Manager, EPA will inform Respondent in writing of the name, address, and telephone number of the new Remedial Project Manager.

56. EPA's RPM shall have the authority lawfully vested in a Remedial Project Manager and On-Scene Coordinator (OSC) by the National Contingency Plan, 40 C.F.R. Part 300. EPA's RPM shall have authority, consistent with the National Contingency Plan, to halt any work required by this Order, and to take any necessary response action.

57. Within ten (10) days after the effective date of this Order, Respondent shall designate a Project Coordinator and shall submit the name, address, and telephone number of the Project Coordinator to EPA for review and approval. Respondent's Project Coordinator shall be responsible for overseeing Respondent's implementation of this Order. If Respondent wishes to change his/her Project Coordinator, Respondent shall provide written notice to EPA, five (5) days prior to changing the Project Coordinator, of the name and qualifications of the new Project Coordinator. Respondent's selection of a Project Coordinator shall be subject to EPA approval.

XIX. ACCESS TO SITE NOT OWNED BY RESPONDENT

58. If the Site, or an off-Site area that is to be used for access, property where documents required to be prepared or maintained by this Order are located, or other property subject to or affected by the clean up, is owned in whole or in part by parties other than those bound by this Order, Respondent will obtain, or use its best efforts to obtain, site access agreements from the present owner within fourteen (14) days of the effective date of this Order. Such agreements shall provide access for EPA, its contractors and oversight officials, the state and its contractors, and Respondent or Respondent authorized representatives and contractors, and such agreements shall specify that Respondent is not EPA's representative with respect to liability associated with Site activities. Respondent shall save and hold harmless the United States and its officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action or other costs incurred by the United States including but not limited to attorneys fees and other expenses of litigation and settlement arising from or on account of acts or omissions of Respondent, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Order, including any claims arising from any designation of Respondent as EPA's authorized representative(s) under section 104(e) of CERCLA. Copies of such agreements shall be provided to EPA prior to Respondent's initiation of field activities. Respondent's best efforts shall include providing reasonable compensation to any off-Site property owner. If access agreements are not obtained within the time referenced above, Respondent shall immediately notify EPA of its failure to obtain access. Subject to the United States' non-reviewable discretion, EPA may use its legal authorities to obtain access for the Respondent, may perform those response actions with EPA contractors at the property in question, or may terminate the Order if Respondent cannot obtain access agreements. Notwithstanding any provision of this Order, EPA retains all of its access authorities and rights, including enforcement authorities related thereto, under CERCLA, RCRA and any other applicable statute or regulations.

XX. SITE ACCESS AND DATA/DOCUMENT AVAILABILITY

59. Respondent shall allow EPA and its authorized representatives and contractors to enter and freely move about all property at the Site and off-Site areas subject to or affected by the work under this Order or where documents required to be prepared or maintained by this Order are located, for the purposes of inspecting conditions, activities, the results of activities, records, operating logs, and contracts related to the Site or Respondent and its representatives or contractors pursuant to this Order; reviewing the progress of the Respondent in carrying out the terms of this Order; conducting tests as EPA or its authorized representatives or contractors deem necessary; using a camera, sound recording device or other documentary type equipment; and verifying the data submitted to EPA by Respondent. Respondent shall allow EPA and its authorized representatives to enter the Site, to inspect and copy all records, files, photographs, documents, sampling and monitoring data, and other writings related to work undertaken in carrying out this Order. Nothing herein shall be interpreted as limiting or affecting EPA's right of entry or inspection authority under Federal law.

60. Respondent may assert a claim of business confidentiality covering part or all of the

information submitted to EPA pursuant to the terms of this Order under 40 C.F.R. 2.203, provided such claim is not inconsistent with section 104(e)(7) of CERCLA, 42 U.S.C. 9604(e)(7) or other provisions of law. This claim shall be asserted in the manner described by 40 C.F.R. 2.203(b) and substantiated by Respondent at the time the claim is made. Information determined to be confidential by EPA will be given to protection specified in 40 C.F.R. Part 2. If no such claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA or the state without further notice to the Respondent. Respondent shall not assert confidentiality claims with respect to any data related to Site conditions, sampling, or monitoring.

61. Respondent shall maintain for the period during which this Order is in effect, an index of documents that Respondent claims contain confidential business information. The index shall contain, for each document, the date, author, addressee, and subject of the document. Upon written request from EPA, Respondent shall submit a copy of the index to EPA.

XXI. RECORD PRESERVATION

62. Respondent shall provide to EPA upon request, copies of all documents and information within their possession and/or control or that of their contractors or agents relating to activities at the Site or to the implementation of this Order, including but not limited to sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondent shall also make available to EPA for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

63. Until ten (10) years after EPA provides notice pursuant to Section XVI of the Statement of Work, Respondent shall preserve and retain all records and documents in its possession or control, including the documents in the possession or control of their contractors and agents on and after the effective date of this Order that relate in any manner to the Site. At the conclusion of this document retention period, Respondent shall notify the United States at least ninety (90) calendar days prior to the destruction of any such records or documents, and upon request by the United States, Respondent shall deliver any such records or documents to EPA.

64. Until ten (10) years after EPA provides notice pursuant to Section XVI of the Statement of Work, Respondent shall preserve, and shall instruct their contractors and agents to preserve, all documents, records, and information of whatever kind, nature or description relating to the performance of the Work. Upon the conclusion of this document retention period, Respondent shall notify the United States at least ninety (90) days prior to the destruction of any such records, documents or information, and, upon request of the United States, Respondent shall deliver all such documents, records, and information to EPA.

65. Within 30 days after the effective date of this Order, Respondent shall submit a written certification to EPA's RPM that it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information relating to its potential liability with regard to the Site since notification of potential liability by the United States or the State or the

filing of suit against it regarding the Site. Respondent shall not dispose of any such documents without prior approval by EPA. Respondent shall, upon EPA's request and at no cost to EPA, deliver the documents or copies of the documents to EPA.

XXII. DELAY IN PERFORMANCE

66. Any delay in performance of this Order that, in EPA's judgment, is not properly justified by Respondent under the terms of this paragraph shall be considered a violation of this Order. Any delay in performance of this Order shall not affect Respondent's obligations to fully perform all obligations under the terms and conditions of this Order.

67. Respondent shall notify EPA of any delay or anticipated delay in performing any requirement of this Order. Such notification shall be made by telephone to EPA's RPM or alternate RPM within forty eight (48) hours after Respondent first knew or should have known that a delay might occur. Respondent shall adopt all reasonable measures to avoid or minimize any such delay. Within five (5) business days after notifying EPA by telephone, Respondent shall provide written notification fully describing the nature of the delay any justification for delay, any reason why Respondent should not be held strictly accountable for failing to comply with any relevant requirements of this Order, the measures planned and taken to minimize the delay, and a schedule for implementing the measures that will be taken to mitigate the effect of the delay. Increased costs or expenses associated with implementation of the activities called for in this Order is not a justification for any delay in performance.

XXIII. ASSURANCE OF ABILITY TO COMPLETE WORK

68. Respondent shall demonstrate its ability to complete the Work required by this Order and to pay all claims that arise from the performance of the Work by obtaining and presenting to EPA within thirty (30) days after approval of the Remedial DesignWork Plan, one of the following: (1) a performance bond; (2) a letter of credit; (3) a guarantee by a third party; or (4) internal financial information to allow EPA to determine that Respondent has sufficient assets available to perform the Work. Respondent shall demonstrate financial assurance in an amount no less than the estimate of cost for the remedial design and remedial action contained in the Record of Decision for the Site. If Respondent seeks to demonstrate ability to complete the remedial action by means of internal financial information, or by guarantee of a third party, they shall re-submit such information annually, on the anniversary of the effective date of this Order. If EPA determines that such financial information is inadequate, Respondent shall, within thirty (30) days after receipt of EPA's notice of determination, obtain and present to EPA for approval one of the other three forms of financial assurance listed above.

69. At least seven (7) days prior to commencing any work at the Site pursuant to this Order, Respondent shall submit to EPA a certification that Respondent or its contractors and subcontractors have adequate insurance coverage or have indemnification for liabilities for injuries or damages to persons or property which may result from the activities to be conducted by or on behalf of Respondent pursuant to this Order. Respondent shall ensure that such insurance or indemnification is maintained for the duration of the Work required by this Order.

XXIV. UNITED STATES NOT LIABLE

70. The United States, by issuance of this Order, assumes no liability for any injuries or damages to persons or property resulting from acts or omissions by Respondent, or its directors, officers, employees, agents, representatives, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order. Neither EPA nor the United States may be deemed to be a party to any contract entered into by Respondent or its directors, officers, employees, agents, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order.

XXV. ENFORCEMENT AND RESERVATIONS

71. EPA reserves the right to bring an action against Respondent under section 107 of CERCLA, 42 U.S.C. 9607, for recovery of any response costs incurred by the United States related to this Order and not reimbursed by Respondent. This reservation shall include but not be limited to past costs, direct costs, indirect costs, the costs of oversight, the costs of compiling the cost documentation to support oversight cost demand, as well as accrued interest as provided in section 107(a) of CERCLA.

72. Notwithstanding any other provision of this Order, at any time during the response action, EPA may perform its own studies, complete the response action (or any portion of the response action) as provided in CERCLA and the National Contingency Plan, and seek reimbursement from Respondent for its costs, or seek any other appropriate relief.

73. Nothing in this Order shall preclude EPA from taking any additional enforcement actions, including modification of this Order or issuance of additional Orders, and/or additional remedial or removal actions as EPA may deem necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA, 42 U.S.C. 9606(a), et seq., or any other applicable law. Respondent shall be liable under CERCLA section 107(a), 42 U.S.C. 9607(a), for the costs of any such additional actions.

74. Notwithstanding any provision of this Order, the United States hereby retains all of its information gathering, inspection and enforcement authorities and rights under CERCLA, RCRA and any other applicable statutes or regulations.

75. Respondent shall be subject to civil penalties under section 106(b) of CERCLA, 42 U.S.C. 9606(b), of not more than $27,500 for each day in which Respondent willfully violates, or fails or refuses to comply with this Order without sufficient cause. In addition, failure to properly provide response action under this Order, or any portion hereof, without sufficient cause, may result in liability under section 107(c)(3) of CERCLA, 42 U.S.C. 9607(c)(3), for punitive damages in an amount at least equal to, and not more than three times the amount of any costs incurred by the Fund as a result of such failure to take proper action.

76. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person for any liability it may have arising out of or relating in any way to the Site.

77. If a court issues an order that invalidates any provision of this Order or finds that Respondent has sufficient cause not to comply with one or more provisions of this Order, Respondent shall remain bound to comply with all provisions of this Order not invalidated by the court's order.

XXVI. ADMINISTRATIVE RECORD

78. Upon request by EPA, Respondent must submit to EPA all documents related to the selection of the response action for possible inclusion in the administrative record file.

XXVII. EFFECTIVE DATE AND COMPUTATION OF TIME

79. This Order shall be effective thirty (30) after the Order is signed by the Regional Administrator. All times for performance of ordered activities shall be calculated from this effective date.

XXVIII. ATTACHMENTS

80. The following attachments are incorporated into this Order:

a. Attachment 1 is the Record of Decision.

b. Attachment 2 is the Explanation of Significant Differences.

c. Attachment 3 is the Statement of Work.

XXIX. OPPORTUNITY TO CONFER

81. Respondent may, within seven (7) days after the date this Order is signed, request a conference with EPA to discuss this Order. If requested, the conference shall occur within ten (10) days of Respondent's request for a conference at EPA's offices at 290 Broadway, New York, New York.

82. The purpose and scope of the conference shall be limited to issues involving the implementation of the response actions required by this Order and the extent to which Respondent intends to comply with this Order. This conference is not an evidentiary hearing, and does not constitute a proceeding to challenge this Order. It does not give Respondent a right to seek review of this Order, or to seek resolution of potential liability, and no official stenographic record of the conference will be made. At any conference held pursuant to Respondent's request, Respondent may appear in person or by an attorney or other representative.

83. Requests for a conference must be by telephone followed by written confirmation mailed that day to Michael Zeolla, Remedial Project Manager, 290 Broadway, New York, New York 10007-1866 (telephone number 212-637-4736).

So Ordered, this 22 day of Sept, 2003.

By: _____
Regional Administrator
U.S. Environmental Protection Agency

Attachment 1

DECLARATION STATEMENT

RECORD OF DECISION

HIGGINS FARM

SITE NAME AND LOCATION

Higgins Farm
Franklin Township, Somerset County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Higgins Farm site, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision document explains the factual and legal basis for selecting the remedy for the second operable unit at this site. The information supporting this remedial action decision is contained in the administrative record.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Higgins Farm site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The remedy described in this document represents the second operable unit for the Higgins Farm site. The first operable unit, which involved an interim ground water remedy, provided for the installation of a water line to supply area residents with an alternate water supply. The remedial action selected in this Record of Decision provides a permanent solution for contaminated ground water at the site. The soils on the site do not appear to pose an unacceptable health risk; therefore, no remedial action for site soils is anticipated.

The major components of the selected remedy include the following:

- Installation of ground water extraction wells around the perimeter of the site and the source areas;

- Construction of an on-site treatment plant to treat the contaminated ground water;

- Discharge of the treated ground water to an on-site surface water body;

- Implementation of a sampling program involving monitoring wells and downgradient residential wells to evaluate off-site migration and the effectiveness of the ground water extraction system;

- Limited investigations to confirm that all sources of contamination have been identified; and

- Removal and proper disposal of contaminated materials which were generated during previous site stabilization and remedial investigation activities that are presently stored on the site.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the extent practicable given the unpredictable nature of the fractured bedrock and stringent surface water discharge standards, and is cost effective. Requirements which cannot be achieved by the remedy may be waived pursuant to Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act, as amended. The selected remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy may result in hazardous substances remaining at the site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

Constantine Sidamon-Eristoff
Regional Administrator
U.S. EPA Region II

Date 9/30/94

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RECORD OF DECISION

HIGGINS FARM

SITE LOCATION AND DESCRIPTION

The Higgins Farm site (the site) is located in a rural residential area on Route 518 in Franklin Township, Somerset County, New Jersey. The site, which is approximately 75 acres in size is owned by Mr. Clifford Higgins Sr., and is operated as a cattle farm (see Figure 1). It is primarily pasture land and is relatively flat and poorly drained. There are two residences located on the site, and other residences bordering the site to the northeast and northwest. Trap Rock Industries' Kingston Quarry borders the site to the south. Figure 2 shows the site boundaries and major features.

Two 3,000 gallon holding tanks containing contaminated water, two empty 10,000 gallon holding tanks, and drums containing material generated during removal and remedial investigation field activities are located in the northern portion of the site. A barn housing excavated containers, drums and roll-off containers of contaminated soils are also located in this area, which is referred to as the excavation pit area. A chain link fence surrounds the tanks, the barn and the area where the drums and containers were excavated. The tanks and the barn were installed during emergency response activities conducted by the U.S. Environmental Protection Agency (EPA). A berm was constructed to prevent runoff from this area onto the remainder of the site.

A small fenced area, which is referred to as the New Jersey Department of Environmental Protection and Energy (NJDEPE) fenced area, where buried drums were discovered during test pit excavation activities, is located in the southwest portion of the site. Demolition debris, including bricks, asphalt, metal scrap, and concrete, is also found near the drum burial area.

The topography of the site is generally flat, but slopes gently down to the southeast. A minor drainage area and pond exist in the southeastern corner of the site. Water from the pond discharges through an unnamed tributary to Carters Brook, approximately 2,000 feet to the east.

Approximately 545 residential and two municipal water supply wells are located within three miles of the site. Within this radius, approximately 3,200 people rely on ground water for their drinking water source. The nearest downgradient public supply wells are three wells operated by the Town of South Brunswick and are located approximately 3.5 miles southeast of the site.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Higgins Farm site was used for the disposal of hazardous wastes, including hazardous substances, under the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA). Aerial photographs covering the period from 1940 to 1983 show disturbed areas in the area of the NJDEPE fenced area and east of the excavation pit area (see Figure 2). During the 1960s, municipal sludge and penicillin wastes were used as fertilizers on Higgins Farm. In December 1985, the Franklin Township Health Department reported to NJDEPE that elevated levels of chlorobenzene existed in a potable well located at Route 518, Franklin Township, Somerset County, New Jersey. NJDEPE investigated and discovered the presence of a drum burial dump at the site approximately forty yards from the contaminated well.

On January 2, 1986, NJDEPE investigated drum excavation activities initiated at the site by Mr. Higgins. The excavation was halted by NJDEPE as the activity had not been approved. The NJDEPE issued a directive to Mr. Higgins on February 24, 1986 instructing him to implement a remedial action plan.

On April 7, 1986, O.H. Materials, a contractor employed by Mr. Higgins recommenced excavation of buried drums with NJDEPE approval. Approximately fifty containers, including drums, were excavated. During excavation activities, some containers were punctured and their contents spilled onto the ground as the drums were excavated. Liquids were pumped from the excavation pit to a holding tank and visibly contaminated soils were placed in roll-off containers. Due to payment disputes, Mr. Higgins terminated O.H. Materials' activities at the site after several days.

On April 26, 1986, NJDEPE sampled ten residential wells in the vicinity of the site and discovered that three wells were contaminated with volatile organic compounds (VOCs). Nine of the ten residential wells were resampled by NJDEPE in August 1986. The analysis confirmed the presence of volatile organic contamination in the ground water.

On May 8, 1986, NJDEPE personnel inspected Higgins Farm and collected soil samples from the site, including the excavation pit area. Analysis of these samples indicated the presence of volatile organic compounds, pesticides, metals, dioxins and furans in the soils at the site. On July 3, 1986, NJDEPE collected another sample from the vicinity of the drum excavation pit. Analysis confirmed the presence of dioxins and associated furans.

On August 27, 1986, NJDEPE personell collected 27 surface soil samples from the site. Samples were collected from an adjacent residence, the excavation pit area, and the two roll-off containers. Samples were analyzed for dioxins and furans. Analysis confirmed the presence of dioxins and associated furans.

In November 1986, NJDEPE established a "well impact area" near the Higgins Farm site, restricting installation of new wells within the affected area. Thirty-one residences were included within the well impact area at Higgins Farm. This well restriction has since been removed by the NJDEPE.

In March 1987, EPA responded to the presence of contamination in drinking water wells neighboring the site by providing bottled water to potentially impacted area residents. At that time, EPA explained that it would provide bottled water as an interim solution until an alternate water supply could be arranged by NJDEPE. Thereafter, NJDEPE determined that the most appropriate method to supply potable water was to install individual carbon units at the potentially impacted homes. NJDEPE installed the carbon filter units during the spring/summer of 1989, at which time bottled water delivery was discontinued. The carbon filter units were intended to limit ingestion of volatile organic compounds and mitigate the potential for human exposure via inhalation of volatile organic compounds through household use.

In March 1987, NJDEPE formally requested that EPA assume the lead role in mitigating the Higgins Farm site. On April 8, 1987, EPA initiated activities to stabilize the site and to control the release of hazardous substances into the environment. The following actions were undertaken:

a. the construction of a barn to house contaminated material, including but not limited to, overpacked drums and roll-off containers;

b. the excavation pit was drained, lined and backfilled;

c. the pumped liquids were treated and stored in holding tanks; and

d. the excavation pit area was fenced to prevent access by unauthorized persons.

In December 1989, NJDEPE advised EPA that it could not monitor and maintain the carbon units beyond the spring of 1990. On February 2, 1990, EPA authorized $625,320 to monitor and maintain the carbon filter units for approximately two years.

The site was proposed for inclusion on the National Priorities List (NPL) in June 1988. EPA began investigations to identify potentially responsible parties (PRPs) for the contamination at the site. In March 1989, the site was formally placed on the NPL, thus making it eligible for federal funds to investigate the extent of contamination and to clean up the site. In March 1989, EPA notified six PRPs of their potential liability. EPA offered these PRPs the opportunity to conduct or finance the Remedial Investigation and Feasibility Study (RI/FS) for the site; however, the PRPs declined to accept EPA's offer.

As a result, EPA allocated funds for the studies to be conducted under EPA supervision through its contractors. EPA has since identified one additional PRP, who also declined to conduct or finance the RI/FS.

On October 17, 1989, EPA offered the PRPs the opportunity to install a water line along Route 518 to service the residents impacted and potentially impacted by the Higgins Farm site to provide a permanent solution to the water supply problem. In February 1990, EPA informed the seven PRPs that the Agency had not received an acceptable offer to install the public water supply.

On March 20, 1990, EPA issued an Administrative Order to Mr. & Mrs. Clifford Higgins Sr. to install the water line. Mr. & Mrs. Higgins have failed to comply with the order.

In June 1990, EPA released the Focused Feasibility Study (FFS) report and EPA's Proposed Plan for the construction of a water line extension to provide the potentially affected residents with an alternate water supply. A public comment period was provided, beginning on June 28 and ending on July 30, 1990.

On September 24, 1990, EPA issued a first Record of Decision (ROD) which selected an interim remedy to connect the potentially affected residents to an existing water supply. The design of the water line has been completed and all necessary approvals from the Township of South Brunswick to connect to its water supply have been obtained. Construction of the water line is scheduled to begin in the near future.

Between March 1990 and July 1992, EPA conducted an RI/FS to define the nature and extent of contamination at the site.

In August 1992, EPA's removal program completed the excavation of 94 drums and contaminated soils which were discovered during test pit excavation activities in the NJDEPE fenced area. Arrangements are currently being made for the proper disposal of these drums and contaminated soils.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan (CRP) for the Higgins Farm site was finalized in March 1990. The CRP lists contacts and interested parties throughout government and the local community. It also establishes communication pathways to ensure timely dissemination of pertinent information.

The RI/FS reports and the Proposed Plan for the second operable unit ground-water remedy were released to the public for comment on July 15, 1992. These documents were made available to the public in the administrative record file at Information Repositories at the Mary Jacobs Memorial Library, the Franklin Township Library and at EPA's Region II Office in New York City. The notice of availability for these

documents was published in The Home News on July, 15, 1992. A public comment period was held from July 15 to September 18, 1992, due to a request to extend the comment period. In addition, a public meeting was held on August 3, 1992, to present the Proposed Plan for the site. At this meeting, representatives from EPA answered questions regarding remedial alternatives under consideration and problems at the site. All comments which were received by EPA prior to the end of the public comment period, including those expressed verbally at the public meeting, are addressed in the Responsiveness Summary which is attached as Appendix I to this Record of Decision.

SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

This is the second of two operable units for the site. The first operable unit provided potentially affected residents located on Route 518 with an alternate water supply to prevent ingestion of contaminated ground water. The primary objectives of the second operable unit, as authorized by this ROD, are to capture and treat the bulk of ground-water contamination found on the site and limit future migration of contaminated ground water to off-site areas.

Many residents in the vicinity of the site depend on ground water as a potable water source. Although the first operable unit provided some area residents with an alternate water supply, there remains the potential for contaminated ground water to migrate from the site to other residential wells. As determined in the risk assessment, exposure to the contaminated ground water could pose a threat to residents who utilize ground water as their potable water supply. Therefore, this action is necessary to treat the contaminated ground water at the site, and restrict the off-site migration of contaminants.

In addition, as described below, the risk assessment concluded that exposure to site soils does not pose a significant risk, with the exception of the soils located in the NJDEPE fenced area which are being addressed as part of the removal action described above. No further action is considered necessary for soils although, as discussed below under **Description of Alternatives**, confirmatory sampling will be performed to ensure that all contaminant sources have been identified. Therefore, this second operable unit remedy focuses solely on ground-water remediation.

SUMMARY OF SITE CHARACTERISTICS

EPA contracted Malcolm Pirnie and CH2M Hill to conduct a Remedial Investigation in late Summer 1989. The purpose of the RI was to accomplish the following:

- identify the nature and extent of contaminant source areas;
- define contamination of ground water, soils, surface water and sediment;

- characterize site hydrogeology; and

- determine the risk to human health and the environment posed by the site.

The RI tasks conducted to accomplish each of these objectives are listed in Table 1.

RI field work was conducted in two phases: from March 1990 through January 1992, and from February 1992 through March 1992. Ground-water, surface and subsurface soil, surface-water, sediments and suspected source area (through test pit excavation) samples were collected and analyzed during Phase I of the RI. Phase II of the RI, which included the excavation of additional test pits and sampling, was conducted to investigate other potential sources of contamination. In addition, hydrogeologic studies were conducted using information obtained during the RI. The results of the RI are summarized as follows.

Site Hydrolgeology

The geology of the site is characterized as unconsolidated material underlain by fractured bedrock. Figure 3 shows a generalized geologic cross section of the site. Hydrogeologic testing of monitoring wells installed in both the overburden and bedrock zones were used to determine site hydrogeology, hydraulic conductivity, ground-water flow directions and velocity, and the vertical gradient between the two water-bearing zones. Results of the hydrogeologic studies indicate that ground water flows through poorly distributed fractures in the bedrock beneath the site, resulting in heterogeneous aquifer conditions. Aquifer anisotropy, which causes ground water to flow preferentially through these fractures, along with the heterogenous conditions, result in complex ground-water flow patterns which make it extremely difficult to ascertain the pattern of local ground-water flow. Detailed results of the hydrogeologic studies can be found in the Remedial Investigation report.

Ground-Water Investigation

Ground-water samples were collected from seven shallow and eight deep on-site monitoring wells. In addition, five residential wells in the vicinity of the site were sampled (see Figure 4). As shown in Table 2, analytical results indicate that numerous contaminants, including volatile organic compounds and metals, are present above federal and state Maximum Contaminant Levels (MCLs). VOCs were detected in 21 of 23 ground-water samples. Tetrachloroethene was the most frequently detected compound, at concentrations ranging from 0.17 to 270 parts per billion (ppb). The compound detected at the highest concentration was benzene at 1,200 ppb. Other VOCs which were detected above federal and state MCLs include: dichloroethane (320 ppb); trichloroethane (1,100 ppb); and vinyl chloride (86 ppb). No semi-volatile organic compounds (semi-VOCs) were detected above federal or state MCLs. The

most frequently detected semi-VOC was dichlorobenzene, at concentrations ranging from 20 to 48 ppb. Inorganic compounds appeared in all samples. The metal detected at the highest concentration was iron at 433,000 ppb. The following metals were detected above federal and state MCLs: beryllium (25.7 ppb); copper (8750 ppb); iron (433,000 ppb); and lead (81.4 ppb).

Source Area Investigation

Test pit excavations were conducted to identify sources of contamination. Thirteen test pits were excavated during Phase I of the RI (see Figure 5). The test pit locations were chosen based on the evaluation of the geophysical and soil gas surveys. A source of contamination was uncovered in the area which NJDEPE formerly designated as a suspected drum burial area. Buried 55-gallon drums, and other containers and refuse were uncovered during excavation. Table 3 summarizes the results of soil samples collected from test pits. The following contaminants were among those detected in soils in the NJDEPE fenced area: trichloroethane (4,400 ppb); tetrachlorethene (47,000 ppb); pentachlorophenol (2,100,000 ppb); arsenic (1,310,000 ppb); and dioxins (222 ppb). This source area is being addressed separately by EPA's removal program. The removal of drums and contaminated soil is expected to be completed in the Fall of 1992.

Six additional test pits were excavated and sampled during Phase II of the RI (see Figure 5). The follow-up test pit program was conducted in March 1992. These test pits were excavated to investigate potential sources of contamination as well as to delineate the extent of contamination in areas where buried drums or contaminated shallow monitoring wells are located. No drums or any other contaminant source material were found during the Phase II test pit excavation.

Surface and Subsurface Soil Investigation

Surface soil samples were collected at 59 locations, including 42 on site and 17 off site (see Figure 6). Sampling of on-site surface soils focused on suspect source areas. The majority of the off-site samples were collected from residential properties adjacent to the site. Results showed that VOCs and semi-VOCs, in both on- and off-site samples, were detected infrequently and at low concentrations. In addition, two pesticides were detected in the on-site samples, but have been determined to most likely have originated from insecticides applied at the site. The inorganics detected on and off the site include arsenic (12,400 ppb) and beryllium (2,000 ppb). Table 4 summarizes the analytical results of surface soils samples collected at the site.

Subsurface soil sampling included the installation of shallow borings, and collection of samples during installation of monitoring wells. VOCs were detected in 11 of the 13 borings. The VOC detected at the highest concentration was tetrachloroethene at 1,100 ppb, however, it was detected at only one location. Semi-VOCs and metals

were detected at low concentrations. Table 5 summarizes the analytical results of subsurface soil samples collected at the site.

As no promulgated federal or state standards exist for surface and subsurface soils, detected concentrations in test pits and soils were evaluated in a site-specific risk assessment. As discussed below in the Summary of Site Risk section, the levels of contamination present in soils do not pose a significant risk to human health or the environment, with the exception of the contaminated soil in the NJDEPE fenced area which is being addressed by EPA's removal program.

Surface-Water and Sediment Investigation

Three surface-water samples were collected from the intermittent on-site pond (see Figure 6). The only VOC detected above the Federal Ambient Water Quality Criteria (FAWQC) for the protection of aquatic life was carbon tetrachloride (1.4 ppb). No semi-VOC's were detected above the FAWQC. The inorganics results indicated that the following metals were detected above the FAWQC: copper (6.4 ppb); iron (4,950 ppb); lead (12 ppb); and zinc (292 ppb).

Seven sediment samples were collected from the pond and three drainage channels at the site. The following semi-VOCs were among those detected: benzo(a)pyrene (500 ppb); benzo(b)fluoranthene (830 ppb); and chrysene (750 ppb). These compounds, however, were detected infrequently. Inorganics detected include arsenic (5,700 ppb) and beryllium (2,000 ppb). Table 6 summarizes the analytical results of sediment samples collected at the site.

SUMMARY OF SITE RISK

EPA conducted a baseline Risk Assessment to evaluate the potential risks to human health and the environment associated with the Higgins Farm site in its current state. The Risk Assessment focused on contaminants in the ground water, soils and sediments. The selection of contaminants of concern (COC) is based on a number of parameters, including the frequency of detection and concentration in each environmental medium, environmental fate and transport characteristics, toxicity, and the likelihodd of exposure. The summary of COC in sampled matrices is listed in Table 7.

Human Health Risk Assessment

EPA's Risk Assessment identified several potential exposure pathways by which the public may be exposed to contaminant releases at the site under current and future land-use conditions. Ground-water, soils and sediment exposures were assessed for a potential present land-use scenario and sediment exposure was assessed for potential future land-use conditions. The baseline risk assessment evaluated the

health effects which could result from exposure to contamination as a result of six exposure pathways: 1) ingestion of chemicals in soil; 2) dermal contact with chemicals in soil; 3) dermal contact with chemicals in ground water; 4) ingestion of chemicals in ground water; 5) inhalation of chemicals in ground water volatilized to air; and 6) dermal contact with contaminants in sediment. For the purposes of this human health evaluation, potentially exposed populations include residents living on or adjacent to the site, farm workers, and site trespassers. These exposure pathways were evaluated separately for adult and child residents. Children are assumed to be under seven years old. All of the exposure pathways identified for the current land use can be expected to continue into the future. In addition, an on-site resident's exposure to sediments was evaluated for the future-use scenario. The exposure pathways considered under current and future-use scenarios are listed in Tables 8 and 9, respectively. The reasonable maximum exposure to COC was evaluated in all cases.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and non-carcinogenic effects due to exposure to COC are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus carcinogenic and non-carcinogenic risk associated exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and non-carcinogens, respectively.

Non-carcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of milligrams per kilogram per day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular medium. The hazard index is obtained by adding the hazard quotients for all compounds across all media that impact a particular receptor population.

A hazard index greater than 1.0 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. A summary of the non-carcinogenic risks associated with the chemicals of concern across the various exposure pathways is found in Table 10.

It can be seen from Table 10, that the HI for non-carcinogenic effects from the ingestion, dermal contact and inhalation of ground water is 6.50 for adult residents and 10.27 for child residents. Therefore, non-carcinogenic effects may occur from the exposure routes evaluated in the Risk Assessment. The non-carcinogenic risk

associated with exposure to contaminated ground water is attributable to several compounds including 1,1,2-trichloroethane and chlorobenzene.

As presented in Table 10, the HI for non-carcinogenic effects from ingestion and dermal contact with contaminants in soil is less than 1.0, indicating that the risk posed by the soils is below EPA's acceptable risk range.

Potential carcinogenic risks were evaluated using cancer slope factors (SFs) developed by EPA for the contaminants of concern. Cancer slope factors have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely.

For known or suspected carcinogens, EPA considers excess upper bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual may have one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure over a 70-year period under specific exposure conditions at the site. Under current land-use conditions, the risk characterization showed that cancer risks associated with each of the ground-water pathways (ingestion, inhalation and dermal contact) exceed Superfund acceptable risk levels for both adults and children. For example, the estimated cancer risk associated with ingestion of ground water is 2×10^{-3} (two in a thousand) for residential adults and 1×10^{-3} for residential children. The total cancer risk posed by contaminated ground water from all pathways considered is 3×10^{-3} for residential adults and 2×10^{-3} for residential children. The cancer risk analysis indicates that 1,1,2-trichloroethane, benzene, vinyl chloride and 1,2-dichloroethane are the main contributors to the estimated cancer risk (see Table 11).

As presented in Table 11, the cancer risks associated with the ingestion and dermal contact with contaminants in soil and sediments are below or within EPA's acceptable risk range, as described above.

The calculations were based on the concentrations of contaminants detected in on-site monitoring wells and residential wells. For many monitoring well locations, ground water from both shallow and deep monitoring wells was sampled and analyzed. Where data was available from both depths, the higher concentration was used to estimate exposure. For purposes of the Risk Assessment, the installation of the waterline, which will provide 30 residents located along route 518 with a safe potable water supply, was not taken into account as the waterline does not protect residents

located downgradient from the site who depend on ground water as their potable water source.

Ecological Risk Assessment

EPA also performed an Ecological risk assessment for the Higgins Farm site. The following were determined to be chemicals of concern in the environmental risk assessment: total polyaromatic hydrocarbons (PAHs); dioxins; and lead. The risk assessment qualitatively evaluated the exposure pathways through which these chemicals could migrate, potentially allowing for receptors to be at risk. For the variety of aquatic and terrestrial species, the most probable routes of exposure to the chemicals of concern were identified as ingestion or direct contact with surface water, sediments or soil containing these compounds.

Due to the intermittent nature of the on-site surface water, the long range impact from surface-water exposure to species that utilize the pond for habitat (e.g., amphibians), from surface-water exposure is deemed to be low. When the surface water is absent, however, these organisms would be exposed to the sediment and soil borne contamination and thus be potentially at risk to these media. Because of the small area of pond sediments, in conjunction with the low frequency of detection of the compounds, the risks due to exposure and ingestion of these media is also low.

The risk to the terrestrial wildlife (e.g., small mammals) was also found to be low for the following reasons. The PAHs were detected in residential areas which are unlikely to be used by wildlife. In addition, a review of the current literature did not indicate that the dioxins and lead detected in soils and sediments would pose any significant risks to these populations.

The site is operated as an active farm for cattle breeding. The cattle are bred and raised at the site and are subsequently sold for human consumption. In August 1987, NJDEPE collected seven milk and two beef tissue samples from the cattle. Dioxins and furans were not detected in the milk samples. As determined by the Food and Drug Administration (FDA), levels of dioxins detected in beef tissue samples were lower than those shown in routine market surveys and are not indicative of a problem. In addition, fencing restricts the cattle from the source areas, i.e., the excavation pit and NJDEPE fenced areas. Therefore, it has been determined that the cattle are not at risk.

As discussed below, the selected remedy will include discharge of treated ground water to on-site surface water. Such a discharge could potentially affect the water quality and increase the potential exposure of the aquatic community to contaminants, causing adverse impacts to the aquatic community. To ensure their continued protection, the selected remedy will include regular monitoring of the surface water. Field visits to the site have indicated that the wooded and wetland portion of the site

provide habitat for a variety of species. No signs of stressed conditions were observed at the site. No records exist showing the presence of rare plants, animals or natural communities on the Higgins Farm site.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainties include:

- environmental chemistry sampling and analysis;
- environmental parameter measurement;
- fate and transport measurement;
- exposure parameter estimation; and
- toxicological data.

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the Risk Assessment provides upper bound estimates of the risks to populations near the site, and is highly unlikely to underestimate actual risks related to the site.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the Risk Assessment report.

Actual or threatened releases of hazardous substances from this site, if not addressed

by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment; they specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on available information and standards such as applicable, or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment.

The following remedial action objectives were established for the second operable unit of the Higgins Farm site:

- To capture and treat the contaminated ground water in an attempt to restore the aquifer to Federal and State drinking water standards;

- To control or limit the future off-site migration of the contaminated ground water; and

- To minimize the potential for direct exposure of the populace to the contaminated ground water.

The ground water flows through fractures in the bedrock such that contaminants may flow more quickly in one direction than in another. Defining the precise location of fractures conveying contaminants which have already migrated from the site and removing all contaminants from bedrock fractures would not be feasible. Therefore, the ground-water remediation goal is to capture and treat the bulk of the contamination on site and limit future off-site contamination to the extent practicable given the complicated nature of site geology.

DESCRIPTION OF ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost-effective, comply with other statutory laws, and utilize permanent solutions, alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

This Record of Decision evaluates in detail, three remedial alternatives for addressing the contamination associated with the Higgins Farm site. The time to implement reflects only the time required to construct or implement the remedy and does not

include the time required to design the remedy, negotiate with the potentially responsible parties, or procure contracts for design and construction. Capital costs, operation and maintenance (O & M) costs, and present worth values are provided for the three alternatives.

These alternatives are:

Alternative 1: No Further Action

Estimated Capital Cost: $0
Estimated Annual O & M Cost: $71,500
Estimated Total Present Worth Value (5-30 years): $309,500 - $1,099,100
Estimated Implementation Period: None

CERCLA requires that the "no-action" alternative be evaluated at every site to establish a baseline for comparison to other alternatives. Under this alternative, EPA would take no further action at the site to prevent exposure to the ground-water contamination, thus the contamination would continue to migrate from the site and could impact downgradient wells in the future. Using existing monitoring wells to the extent possible, a long-term ground-water monitoring program would be implemented to monitor contaminant concentrations remaining at the site and migrating downgradient. For cost estimation purposes, it was assumed that sampling would occur on a semi-annual basis.

Because this alternative would result in contaminants remaining at the site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the contaminated ground water. The above cost estimate includes the cost to perform this review. Details of the costs associated with Alternative 1 are shown in Table 12.

Alternative 2: Source Area Ground-Water Extraction and Treatment

Estimated Capital Cost: $1,353,299
Estimated Annual O & M Cost: $262,100
Estimated Total Present Worth Value (5-30 years): $2,487,900 - $5,382,300
Estimated Implementation Period: 1 year

The ground-water capture zone of this alternative would attempt to remediate only the contaminated ground water in the vicinity of the two source areas; the excavation pit area and the NJDEPE fenced area. This alternative includes the installation of approximately six bedrock ground-water extraction wells around the source areas, treatment of the contaminated ground water and discharge of the treated effluent to the on-site surface water. Figure 7 provides a simulation of the anticipated source area capture zone for this alternative. For cost estimation purposes, the treatment

system was assumed to include metals precipitation, flocculation, clarification, and filtration followed by aeration (air stripping), intermediate pH adjustment, ion exchange and final pH adjustment (see Figure 8). The actual number and placement of extraction wells and the exact nature of the treatment system would be determined during design of the system.

Alternative 2 includes a ground-water and surface-water monitoring program to evaluate the performance of the remedial action. This program would include monitoring of on- and off-site monitoring wells (which may include the installation of additional off-site monitoring wells), and residential wells. Additional well surveys to identify existing potable wells in the vicinity of the site would also be conducted under this alternative.

As the goal of this alternative is to restore the aquifer to drinking water standards, there is some uncertainty associated with the required time frame for achieving these goals. Thus, the cost estimate is based on an estimated treatment period of 5 to 30 years, as shown in the cost sensitivity analysis in Table 13. The cost of this alternative could range from $2,487,900 to 5,382,300 depending on the length of time required to remove contaminants. This ground-water treatment system would be monitored regularly for effectiveness in containing and treating the contaminated ground water.

This alternative would also include limited investigations of the following areas to confirm that all sources have been identified: the grain pile located in the feedstock area; an abandoned hand-dug well; the excavation pit area; and a small area located in the northwest portion of the site that could not previously be investigated due to the presence of livestock. EPA does not anticipate the discovery of additional sources of contamination.

Contaminated material presently stored at the site, including those materials generated during site stabilization and remedial investigation activities, would be removed from the site as part of this alternative. EPA suspects that some of these wastes may contain dioxin, which would limit disposal options. Therefore, the waste may be stored at the site until such time that proper disposal can be arranged.

In addition, in order to increase the effectiveness of the extraction wells, artificial enhancement of fractures around extraction wells may be considered during the design of the remedial action. This would be accomplished through controlled blasting or use of high pressure water to enlarge existing fractures, or create new fractures around individual wells.

A summary of the ARARs associated with Alternative 2 is provided in the **Summary of the Comparative Analysis of Alternatives** section.

Details of the costs associated with Alternative 2 are shown in Table 14.

Alternative 3: Site-Wide Ground-Water Extraction and Treatment

Estimated Capital Cost: $2,544,800
Estimated Annual O & M Cost: $384,000
Estimated Total Present Worth Value (5-30 years): $5,990,000 - $8,447,600
Estimated Implementation Period: 1.2 years

In order to address site-wide ground-water contamination, this alternative includes a more encompassing, site-wide ground-water extraction system . This alternative is similar to Alternative 2 except that it includes the installation of approximately sixteen bedrock ground-water extraction wells around the perimeter of the site as well as around the two source areas. Figure 9 provides a simulation of the anticipated site-wide capture zone for this alternative. For cost purposes, the treatment system was assumed to include metals precipitation, flocculation, clarification, and filtration followed by aeration (air stripping), intermediate pH adjustment, ion exchange, and final pH adjustment. The actual number and placement of extraction wells and the exact nature of the treatment system would be determined during design of the system.

As in Alternative 2, a ground-water and surface-water monitoring program would be implemented to evaluate the performance of the remedial action. This program would include monitoring of on- and off-site monitoring wells (which may include the installation of additional off-site monitoring wells), and residential wells. Additional well surveys to identify existing potable wells in the vicinity of the site would also be included under this alternative.

As in Alternative 2, because the exact length of time the treatment system would be operated is unknown, it would be monitored regularly for effectiveness in containing and treating the contaminated ground water. Therefore, the cost of this alternative could range from $5,990,000 to $8,447,600 depending on the length of time the system is operated as shown in Table 13.

In addition, this alternative will include the previously described limited investigations to confirm that all sources have been identified and the removal of contaminated material presently stored at the site.

In order to increase the effectiveness of the extraction wells, artificial enhancement of fractures around extraction wells may be considered during the design of the remedial action.

A summary of the ARARs associated with Alternative 3 is provided under the **Summary of the Comparative Analysis of Alternatives** section.

Details of the costs associated with Alternative 3 are shown in Table 15.

SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative was assessed utilizing nine evaluation criteria as set forth in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01. These criteria were developed to address the requirements of Section 121 of CERCLA to ensure all important considerations are factored into remedy selection decisions.

The following "threshold" criteria are the most important, and must be satisfied by any alternative in order to be eligible for selection:

1. *Overall protection of human health and the environment* addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs* addresses whether or not a remedy would meet all of the applicable, or relevant and appropriate requirements of federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. *Long-term effectiveness and permanence* refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. *Reduction of toxicity, mobility, or volume through treatment* is the anticipated performance of a remedial technology, with respect to these parameters, that a remedy may employ.

5. *Short-term effectiveness* addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation periods until cleanup goals are achieved.

6. *Implementability* is the technical and administrative feasibility of a remedy,

including the availability of materials and services needed.

7. *Cost* includes estimated capital and operation and maintenance costs, and the present worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. *State acceptance* indicates whether, based on its review of the RI/FS and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the preferred alternative.

9. *Community acceptance* refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows.

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

As the no-action alternative does not include ground-water treatment or migration control, it provides no reduction in risk and is not considered to be protective of human health and the environment.

Alternative 2, source-area ground-water extraction and treatment, affords protection of human health and the environment through extraction and treatment of contaminants in ground water. By controlling contaminant migration within the source area capture zone, the extraction system aids in the prevention of exposure to contaminated ground water. However, as this alternative focuses on the source areas only, contamination would continue to migrate from other areas of the site. The monitoring of off-site residential and monitoring wells would provide additional protection by determining if contaminants are migrating from the site toward downgradient receptors. The effluent from the ground-water treatment system would be designed to meet the discharge requirements shown in Table 17, which are considered to be protective of human health and the environment.

Alternative 3, site-wide ground-water extraction and treatment, affords greater protection of human health and the environment than Alternative 2 since the capture zone for Alternative 3 encompasses the entire site. Therefore, Alternative 3 would allow less contaminated ground water to migrate from the site. In addition, as

Alternative 3 includes more extraction wells, it is expected that a greater volume of contaminated ground water will be extracted from the aquifer. However, as in Alternative 2, due to the complex nature of the site geology, some contamination may remain in the fractured bedrock at the end of the remediation time period. The monitoring of off-site residential and monitoring wells would provide additional protection in Alternative 3 as well. The effluent from this treatment system would meet discharge requirements considered to be protective of human health and the environment.

Compliance with Applicable Relevant and Appropriate Requirements

The technologies and methods proposed for use under the ground-water remedial alternatives would be designed and implemented to satisfy all corresponding ARARs, as described below.

Chemical-Specific ARARs

Chemical-specific ARARs are health- or environmentally-based numerical values limiting the amount of a contaminant that may be discharged to, or allowed to remain in environmental media.

GROUND WATER

It has been determined that the site is located within the boundaries of the 15 Basin Sole Source Aquifer, a ground-water protective designation authorized by the Safe Drinking Water Act. Standards which are considered ARARs for the site include: Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels, Federal Resource Conservation and Recovery Act (RCRA) Maximum Concentration Limits, and State of New Jersey standards [New Jersey Safe Drinking Water Act A-280 Amendments and New Jersey Pollution Discharge Elimination System regulations (N.J.A.C. 7:14A-1.1 et seq.), N.J.A.C. 7:10-16 et seq. and 7:9-6 et seq.]. CERCLA requires remedies to comply with promulgated state requirements which are more stringent than federal requirements. Therefore, the most stringent standard is the cleanup goal for ground water at the site. Table 16 lists the chemicals found in the ground water at the site with their federal and state standards. The last column in the table provides the cleanup requirement for each chemical.

Alternative 1 does not involve active remediation and is not expected to meet chemical-specific ARARs in ground water. Natural flushing of ground water, in time, may eventually result in achievement of ARARs in ground water. The time frame is unknown, but would be expected to take many years.

Alternative 2 involves active remediation of ground water in the vicinity of the source areas. However, due to the difficulties in extracting contaminated ground water from

fractured bedrock, the time frame for achieving ARARs is difficult to estimate. Furthermore, since this alternative only addresses the source areas, ARARs will not be achieved outside the source area capture zone. Some decreases in contaminant levels can be expected over time. Alternative 3 will include more extraction wells than Alternative 2 and therefore is expected to remove and treat more contaminated ground water. Thus, Alternative 3 is more likely to achieve ARARs in the aquifer than Alternative 2. The time frame for Alternatives 2 and 3 to achieve compliance with chemical-specific ARARs in the underlying bedrock aquifer is difficult to estimate. Alternative 3 represents a more aggressive approach to attaining ARARs in the aquifer, and greater decreases in contaminant levels can be expected with this alternative.

AIR

Air emissions from the treatment systems associated with Alternatives 2 and 3 would be required to meet both Federal and State air quality standards and regulations including the following: National Ambient Air Quality Standards, 40 CFR Part 50; and New Jersey Air Pollution Control Regulations, N.J.A.C. 7:27 et seq.

SURFACE WATER

Pursuant to the Clean Water Act, EPA developed Federal Ambient Water Quality Criteria (FAWQC). EPA has determined that these criteria are relevant and appropriate requirements. The surface discharge requirements selected for the Higgins Farm site generally are the FAWQC for the protection of aquatic life. However, for those compounds for which the laboratory minimum detection level (MDL) is greater than the FAWQC (i.e., the concentration determined by the FAWQC cannot be detected), compliance with the FAWQC will be shown by meeting the lowest MDL available through the EPA contract laboratory program. In addition, for certain compounds, an anti-degradation limitation may be applicable. This is to minimize degradation of existing water quality (i.e., the discharge limit should not be higher than the ambient concentration in the surface water).

The treatment system conceptually developed in the FS for Alternatives 2 and 3 represents the best available technology for the constituents present in site ground water. The system includes metals precipitation, flocculation, clarification, and filtration, followed by aeration (air stripping), intermediate and final pH adjustments, as well as a polishing step for metals removal.

EPA determined that this treatment system would be the most appropriate for achievement of the FAWQC. In addition, it is anticipated that this system will achieve the anti-degradation limits. As shown in Table 17, the discharge from the treatment system should meet the FAWQC and the antidegradation limits. However, these requirements are rather stringent and may be difficult to achieve with the selected technology which, as stated above, represents the best available technology. If, upon

operation of the treatment system, it is determined that the selected discharge requirements cannot be achieved, these requirements may be waived based on the technical impracti- ab-lity of achieving further contaminant reduction.

Action-Specific ARARs

Action-specific ARARs are either technology or activity based limitations which apply to remedial actions.

Since Alternative 1 does not involve active remediation, it has no associated action-specific ARARs.

The action-specific ARARs associated with both Alternatives 2 and 3 include the following: Clean Water Act, 33 U.S.C. 1251 et seq., for discharge to surface water; Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq., for operation of the ground-water treatment system; National Ambient Air Quality Standards, 40 CFR Part 50, for air emissions from the ground-water treatment system; DOT Rules for Hazardous Materials Transportation for The Transportation of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558; Hazardous and Non-hazardous Waste Regulations, N.J.A.C., 7:26 et seq; Air Pollution Control Regulations, N.J.A.C. 7:27 et seq; Spill Notification requirements, N.J.A.C. 7:1(e); Notice of Release of Hazardous Substances to Atmosphere, N.J.S.A. 26:2c-19; Occupational Safety and Health Administration requirements, 29 U.S.C. 651 et seq.; General Requirements for Permitting Wells, N.J.A.C. 7:9-7; and Sealing of Wells Procedures, N.J.S.A.58:4A-5 et seq.

In addition, any sludge generated by the operation of the ground-water treatment plant would have to be disposed of in accordance with the requirements of the Resource Conservation and Recovery Act, including the Land Disposal Restrictions.

As treated ground water would be discharged to surface water, the requirements included in Table 17, as discussed above, would also be action-specific ARARs for the ground-water treatment system included in both Alternatives 2 and 3.

It is expected that both Alternatives 2 and 3 would address and comply with all action-specific ARARs listed above.

Location-Specific ARARs

Location-specific ARARs restrict activities or limit concentrations of contaminants in effluent because a site is in a special location such as a floodplain, wetland, or historical area.

Since Alternative 1 does not involve active remediation, it has no associated location-specific ARARs.

The location-specific ARARs associated with Alternatives 2 and 3 include the following: Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.; Clean Water Act; National Historic Preservation Act of 1966 as amended, 16 U.S.C. 470 et seq.; New Jersey Flood Hazard Area Regulations, N.J.A.C. 7:13-1.1 et seq.; and New Jersey Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A-1.1 et seq.

Alternatives 2 and 3 would comply with all the location-specific ARARs listed above. For the National Historic Preservation Act of 1966, as amended, a Stage 1A cultural resource survey was conducted at the site. The only portion of the site of historic interest is the nucleus of the Higgins Farmstead. Therefore, if the area of the farmstead nucleus will be affected by remedial actions, a Stage 1B-level archeological study will be performed in accordance with the National Historic Preservation Act of 1966, as amended, to determine whether potentially significant historic archeological resources exist that can be associated with the early history of this property.

A wetlands delineation and assessment will be performed during remedial design to determine whether any remedial actions will have an adverse impact on wetlands at the site. Treatment system design and construction for both Alternatives 2 and 3 would have to address and avoid any potential adverse impacts on wetlands that are identified.

PRIMARY BALANCING CRITERIA

Long-term Effectiveness and Permanence

Alternative 1 would not remove or control migration of contaminants in the ground water. Contaminants from the site would continue to migrate from the site which would increase the volume of contaminated ground water. The no-action alternative is not considered to be effective over the long term because contaminated ground water remains at the site and continues to migrate downgradient.

Alternative 2 is expected to be generally effective in providing cleanup of the aquifer in the source-area capture zone, although some contamination may remain in fractures at the end of the remediation time period. Due to the complex nature of the site geology, it is difficult to determine how effective pumping of the wells adjacent to the source areas will be in extracting contaminated ground water and controlling overall contaminant migration to downgradient receptors and the associated long-term risks due to the nature of fractured bedrock.

Alternative 3 is expected to be more effective than Alternative 2 in providing cleanup of the aquifer, because it involves a more encompassing site-wide capture zone. Although this alternative involves removal of a larger volume of contaminated ground water (i.e., less is likely to remain in the fractured bedrock) and more effectively prevents the off-site migration of contaminated ground water, it is possible that some

contamination may still remain in fractures at the end of the remediation time period.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 1 would not involve any containment, removal, treatment, or disposal of contaminated ground water. Therefore, this alternative would not result in any immediate reduction in toxicity, mobility or volume. Contaminants would continue to migrate to off-site areas as well as into deeper fractures of the bedrock resulting in an increase in the volume of contaminated ground water.

Alternative 2 is expected to directly reduce the toxicity, mobility and volume of contaminants in ground water within the source-area capture zone through treatment. As previously stated, due to the complex nature of fractured bedrock, some contamination may remain in the interconnecting fractures of the bedrock and may continue to migrate from the site.

Alternative 3 is expected to further reduce the toxicity, mobility and volume of contaminants in ground water. Some contamination may still remain in the interconnecting fractures of the bedrock in this alternative as well, but to a lesser extent. The Alternative 3 capture zone is more encompassing than that of Alternative 2 and, therefore, would provide a greater reduction of contamination through extraction and treatment of greater volumes of contaminated ground water.

Short-term Effectiveness

Alternative 1 presents no significant short-term risk to residents adjacent to the site as their wells are connected to treatment units. There is no known contamination of residential wells within a one-mile radius of the site. However, under this alternative, ground water will continue to migrate from the site and present a risk to those downgradient residents.

Alternatives 2 and 3 do not pose any significant short-term risks to the community during construction and implementation of the remedy. Construction workers will follow applicable health and safety requirements during implementation of the remedy.

The time required to implement Alternative 2 is estimated to be two years for design and construction. Upon system startup, this alternative will immediately begin to control migration of ground-water contaminants from the source-area capture zone.

The time required to implement Alternative 3 is approximately two months longer than Alternative 2 due to the greater number of wells to be installed. Upon system startup, this alternative will also immediately begin to control ground-water contaminants from migrating from the more encompassing site-wide capture zone.

Implementability

Limited effort would be required to monitor and maintain the elements of Alternative 1. There are several monitoring wells at and near the site that can be used for ground-water monitoring.

Although Alternative 1 is the simplest to implement, the components of Alternatives 2 and 3 can be designed and installed relatively easily. The components of the treatment system are readily available and have proven effective in addressing similar ground-water contamination. The effectiveness of the ground-water pumping will depend on how well the extraction wells are located such that they intercept productive fractures. In general, it may not be possible to pump all of the contaminated ground water from the fractured bedrock within the respective capture zones. If appropriate, further remedial measures, such as installing additional wells, can be easily implemented.

Cost

There are no capital costs associated with Alternative 1. Annual operation and maintenance costs for long-term ground-water monitoring are estimated to be $71,500, for a present worth over five to thirty years of $309,500 - 1,099,100. Alternative 1 is the least costly of the three alternatives.

Capital costs for Alternative 2 are estimated to be $1,353,299. Annual operation and maintenance is estimated to be $262,100. Since it is difficult to predict how long the system would operate, the present worth costs are given in five-year increments, from 5 to 30 years, resulting in a cost range of $2,487,900 - $5,382,300 for Alternative 2.

The cost for Alternative 3 is approximately 50 percent higher than Alternative 2. Although this is the most costly alternative, it provides the greatest protection of human health and the environment. Capital costs for Alternative 3 are estimated to be $2,544,800. Annual operation and maintenance is estimated to be $384,000. The present worth cost range for this alternative is $5,990,000 - 8,447,600.

MODIFYING CRITERIA

State Acceptance

EPA has involved the New Jersey Department of Environmental Protection and Energy in the RI/FS and remedy selection process. The NJDEPE was provided the opportunity to comment on the draft RI/FS documents and the Proposed Plan, and was present at the public meeting held on August 3, 1992 to inform the public of the results of the RI/FS and the Proposed Plan. The NJDEPE has not yet indicated if it concurs with the selected remedy.

Community Acceptance

EPA solicited input from the community on the remedial alternatives proposed for the ground-water contamination at the Higgins Farm site. In general, the community has expressed agreement with EPA's selected remedy. The attached responsiveness summary addresses all comments received during the public comment period.

SELECTED REMEDY

EPA has selected Alternative 3 as the remedy for the Higgins Farm site. This remedy is comprised of the following components:

- Installation of ground-water extraction wells around the perimeter of the site and around the source areas. For cost estimation purposes, sixteen wells are proposed;

- Treatment of the contaminated ground water by processes which are expected to include metals precipitation, flocculation, clarification, and filtration, followed by aeration(air stripping), intermediate pH adjustment, ion exchange, and final pH adjustment;

- Discharge of treated ground water to the on-site surface water body;

- Implementation of a program for sampling of on-site and off-site monitoring wells and downgradient residential wells to evaluate the potential for off-site migration and the effectiveness of the extraction system;

- Limited investigations to confirm that all sources of contamination have been identified;

- Removal and proper disposal of contaminated materials generated during previous site stabilization and remedial investigation activities which are presently stored at the site.

The remedial design will specify the appropriate number and location of wells, and system parameters for the ground-water treatment system. Some modifications or refinements may be made to the remedy during remedial design, construction and operation.

The selection of this remedy is based upon the comparative analysis of the ground-water alternatives discussed above, and provides the best balance of tradeoffs with respect to the nine evaluation criteria. ARARs for the selected remedy are provided in the discussion Attainment of Applicable or Relevant and Appropriate Requirements of

Environmental Laws in the following section.

CONTINGENCY MEASURES

As previously discussed, the goal of this remedial action is to capture and treat the bulk of the ground-water contamination at the site and limit future off-site contamination to the extent practicable, as well as to restore the ground water to its beneficial use, which is, as stated above, a drinking water aquifer. Based on information obtained during the RI, EPA believes that the selected remedy may be able to achieve this goal. However, the ability to achieve cleanup standards (i.e., Federal and State MCLs) cannot be determined until the extraction and treatment system has been implemented and its efficiency and effectiveness are monitored over time.

During operation of the remedial action, if it becomes apparent that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goals, treatment system operations may be discontinued or adjusted and the remedy reevaluated. If it is determined that the selected remedy is not effective in extracting or treating contaminated ground water at the site, contingency measures may be taken.

Those contingency measures may include discontinuing pumping at unproductive extraction wells, installing additional extraction wells to facilitate or accelerate cleanup of ground-water contamination, and alternating pumping wells to eliminate stagnation points. These contingency measures will be protective of human health and the environment.

If it is determined that in spite of any contingency measures that may be taken, the aquifer cannot be restored to its beneficial use, ARARs may be waived in accordance with the statutory waiver provisions of CERCLA based on the technical impracticability of achieving further contaminant reduction.

The decision to invoke a contingency measure may be made during the five year periodic review of the selected remedy.

The estimated cost range for the selected remedy is $5,990,000 - $8,447,600 over a time period of five to thirty years, depending on how long the treatment system is operated.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA also requires that when complete, the selected remedial action for the site will comply with applicable or relevant and appropriate environmental

standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that include treatment as a principal element. The following sections discuss how the selected remedy for contaminated ground water at the Higgins Farm site meets these statutory requirements.

Protection of Human Health and the Environment

The selected ground-water remedy protects human health and the environment by reducing levels of contaminants in the ground water through extraction and treatment as well as through containment of the plume. Of the three alternatives evaluated, the selected alternative provides greater protection of human health and the environment as its capture zone encompasses the entire site and, therefore, is able to extract and treat a greater volume of contaminated ground water over the remediation time period. However, due to the complex nature of the site geology, some contamination may still remain in the fractured bedrock at the end of the remediation time period. Monitoring of on- and off-site monitoring wells, as well as off-site residential wells would provide additional protection to human health and the environment. The treatment system will be designed such that the effluent will meet discharge requirements considered to be protective of human health and the environment, to the extent practicable.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will be designed to meet all chemical-specific, action-specific, and location-specific ARARs discussed under **Summary of Comparative Analysis of Alternatives**, above.

However, due to the complex nature of the fractured bedrock, the selected remedy may not meet all chemical-specific ARARs for the remediation of ground water (see Table 16). Similarly, the selected remedy is conceptually designed to achieve compliance with ARARs for the discharge to surface water (see Table 17). These limitations are rather stringent and may be difficult to achieve with the available technology. The selected remedy, however, will comply with these ARARs to the extent practicable. If the treatment system cannot comply with these limitations, alternate limitations will be developed by EPA in conjunction with NJDEPE.

Cost Effectiveness

The selected remedy is cost-effective in mitigating risks posed by contaminated ground water. Although the selected remedy is the most costly of the three alternatives evaluated, it provides the greatest effectiveness in attaining the threshold criteria. The estimated cost for the selected ground-water remedy, over a five to thirty

year period, is $5,990,000 - $8,447,600, depending the length of time the system is operated.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected ground-water remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the Higgins Farm site. The selected remedy for ground water provides the best balance of tradeoffs with respect to the nine evaluation criteria.

Preference for Treatment as a Principal Element

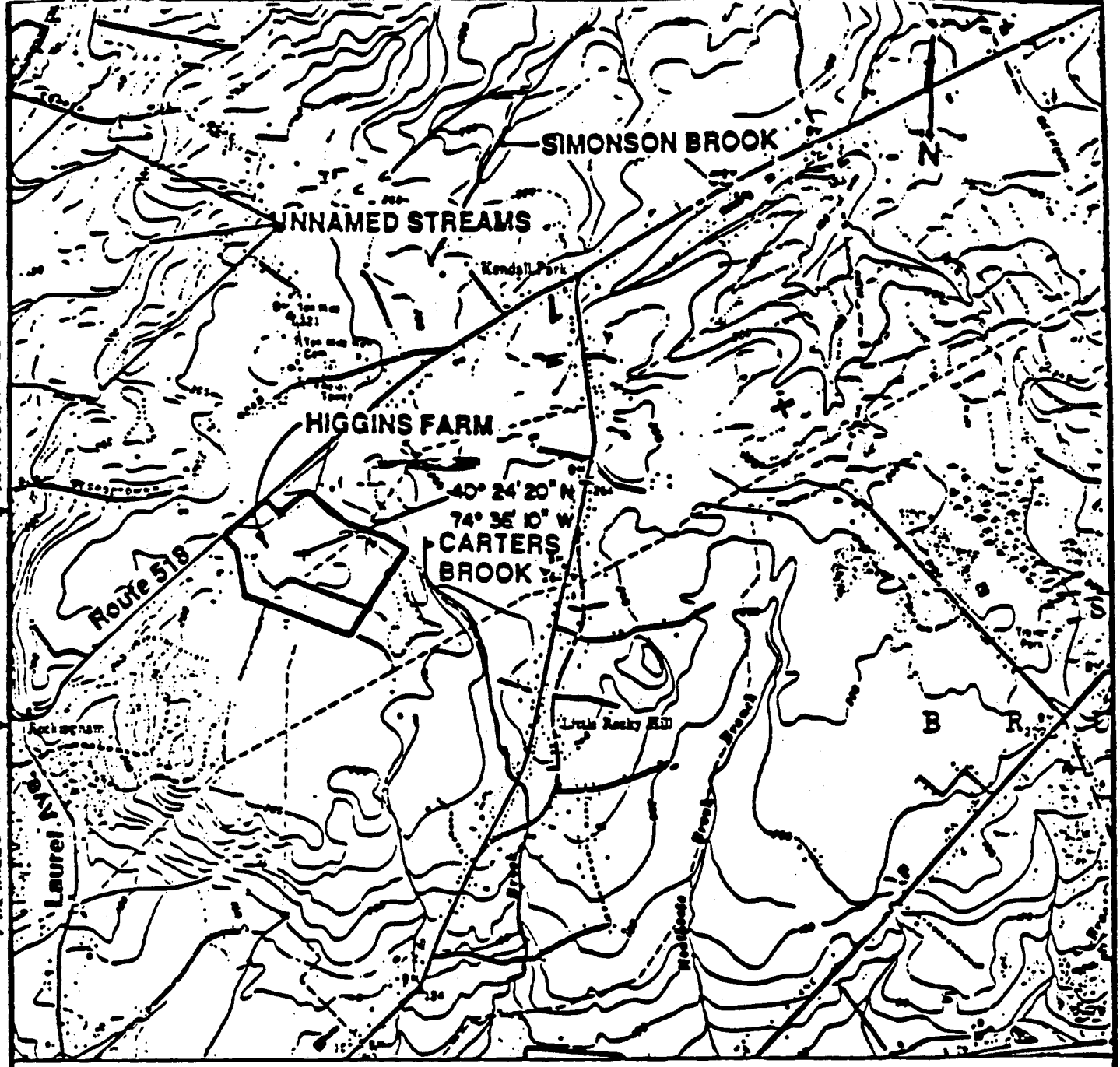
The selected remedy satisfies the statutory preference for treatment as a principal element. The selected remedy utilizes treatment to reduce levels of contamination in ground water to achieve applicable surface-water discharge limits, to the extent practicable.

Documentation of Significant Changes

The Proposed Plan for the site was released to the public in July 1992. This Plan identified Alternative 3 as the preferred alternative to remediate the ground-water contamination at the Higgins Farm site. Upon review of all comments submitted, EPA determined that no significant changes to the selected remedy, as it was presented in the Proposed Plan, were necessary.

APPENDIX I

FIGURES



MONMOUTH JUNCTION QUADRANGLE
NEW JERSEY
7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE 1:24000

1 MILE
1000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FIGURE 1
FRANKLIN TOWNSHIP
SOMERSET COUNTY
LOCATION MAP
HIGGINS FARM

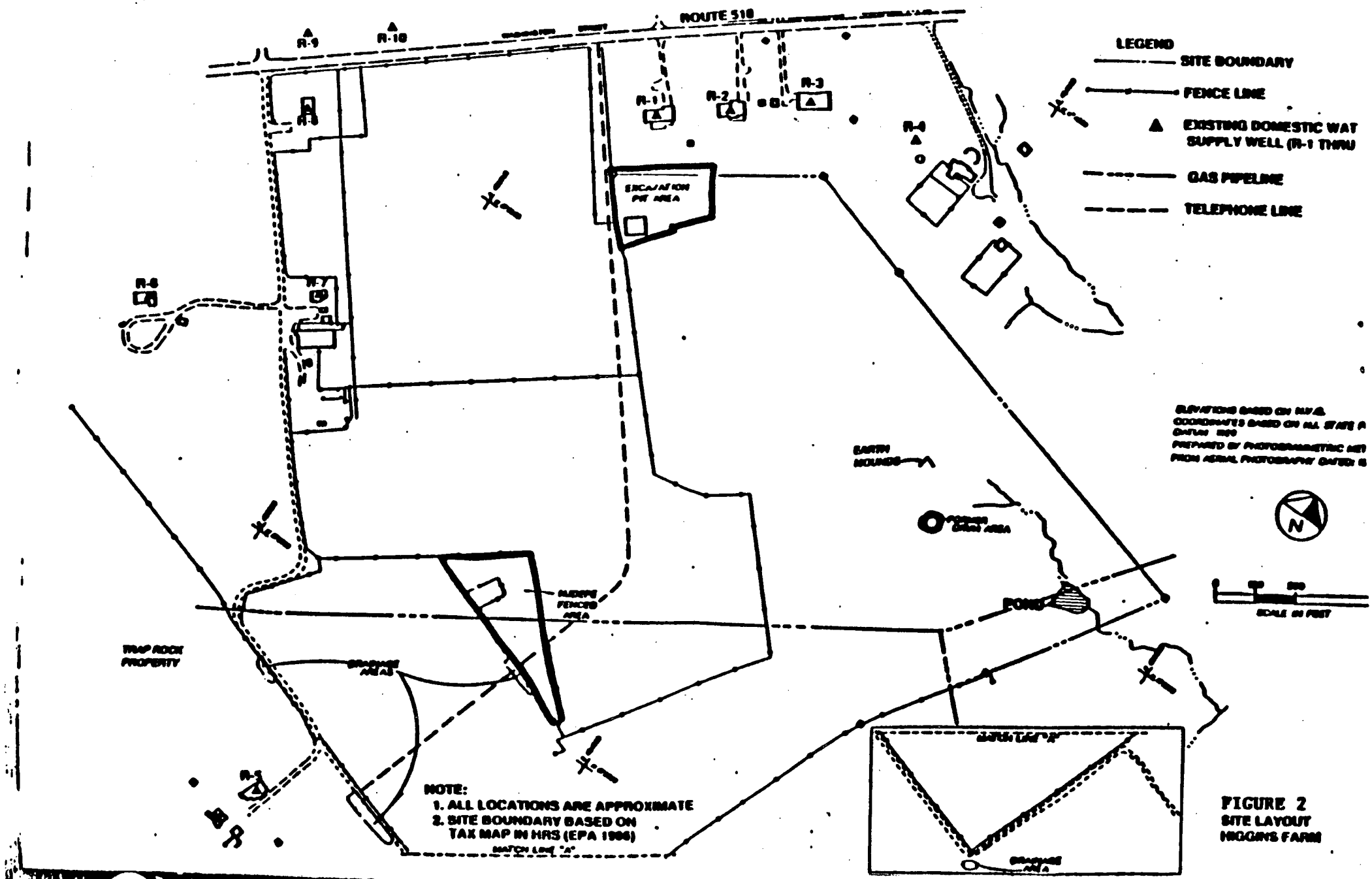
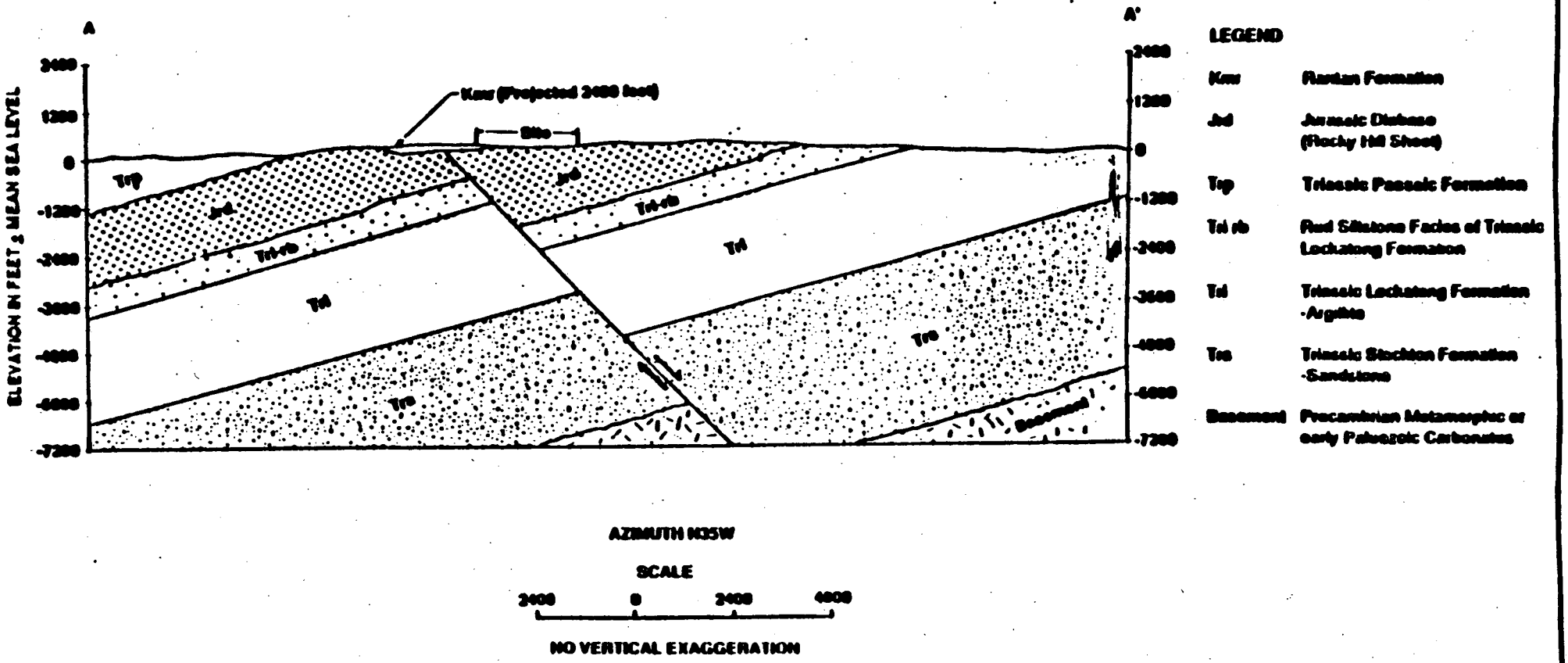


FIGURE 2
SITE LAYOUT
HIGGINS FARM



SOURCE: INTERPRETED FROM USEPA 1986a.

FIGURE 3
GENERALIZED GEOLOGIC CROSS SECTION A- A'
HIGGINS FARM

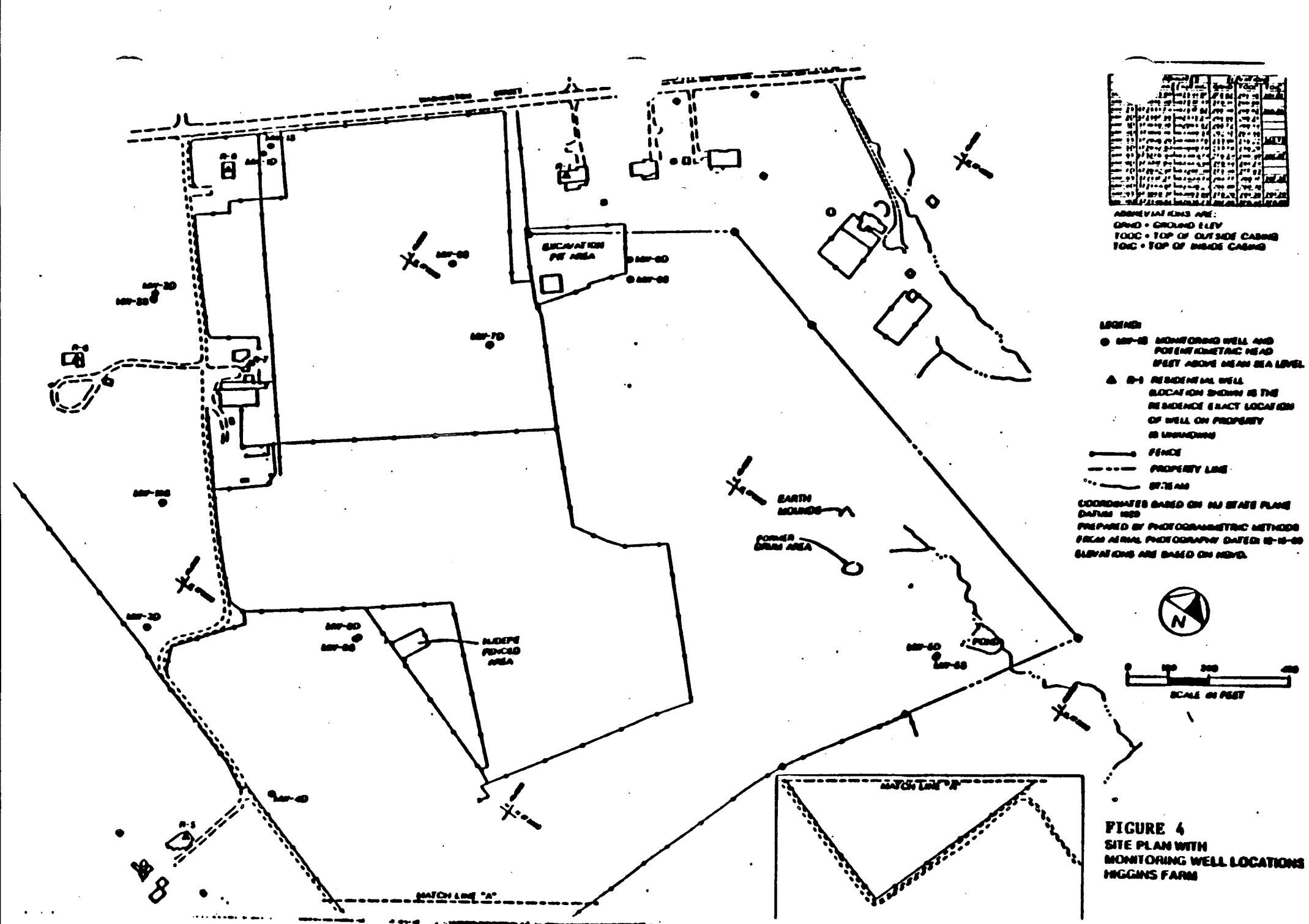


FIGURE 4
SITE PLAN WITH MONITORING WELL LOCATIONS HIGGINS FARM

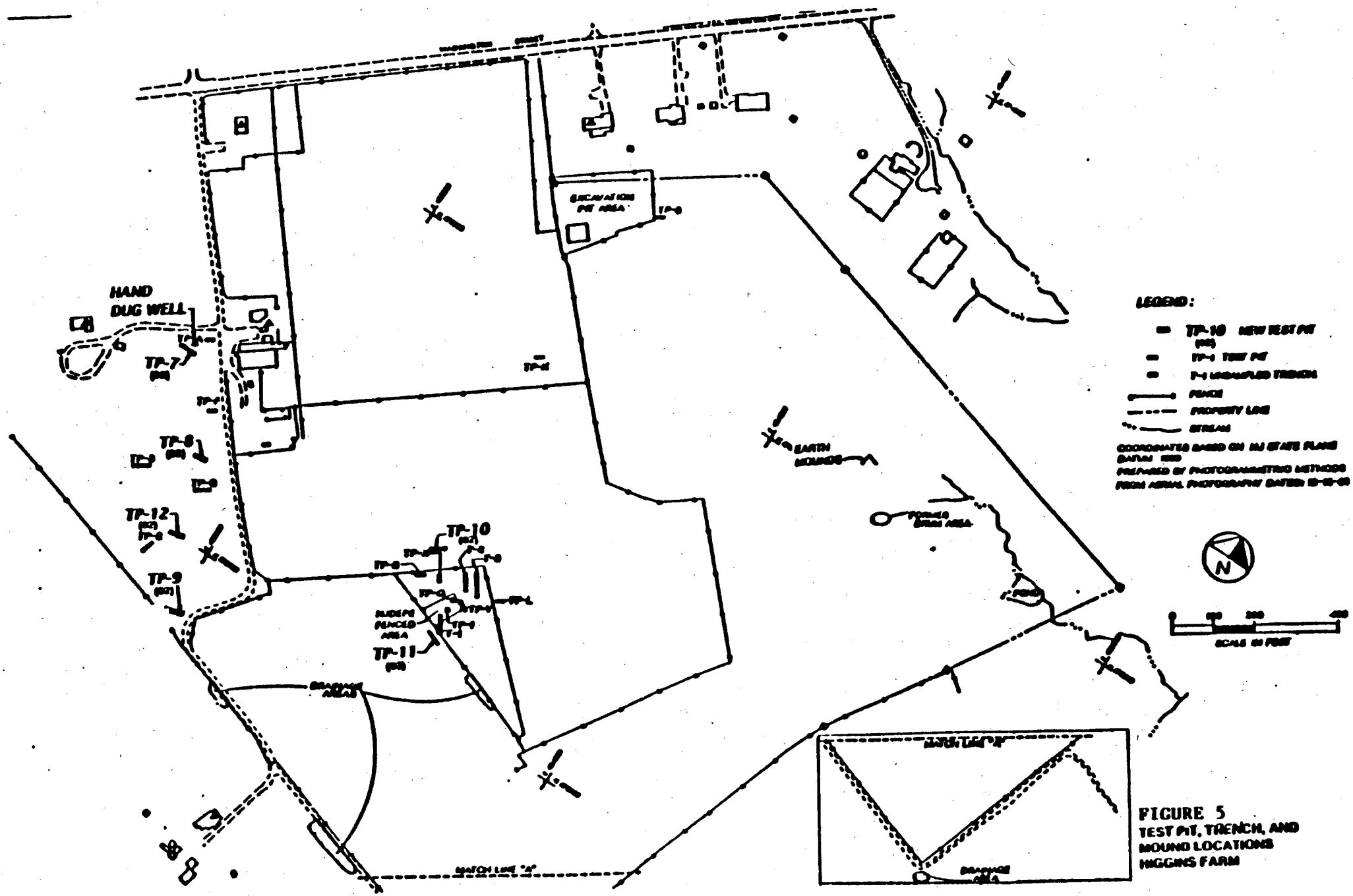


FIGURE 5
TEST PIT, TRENCH, AND MOUND LOCATIONS HIGGINS FARM

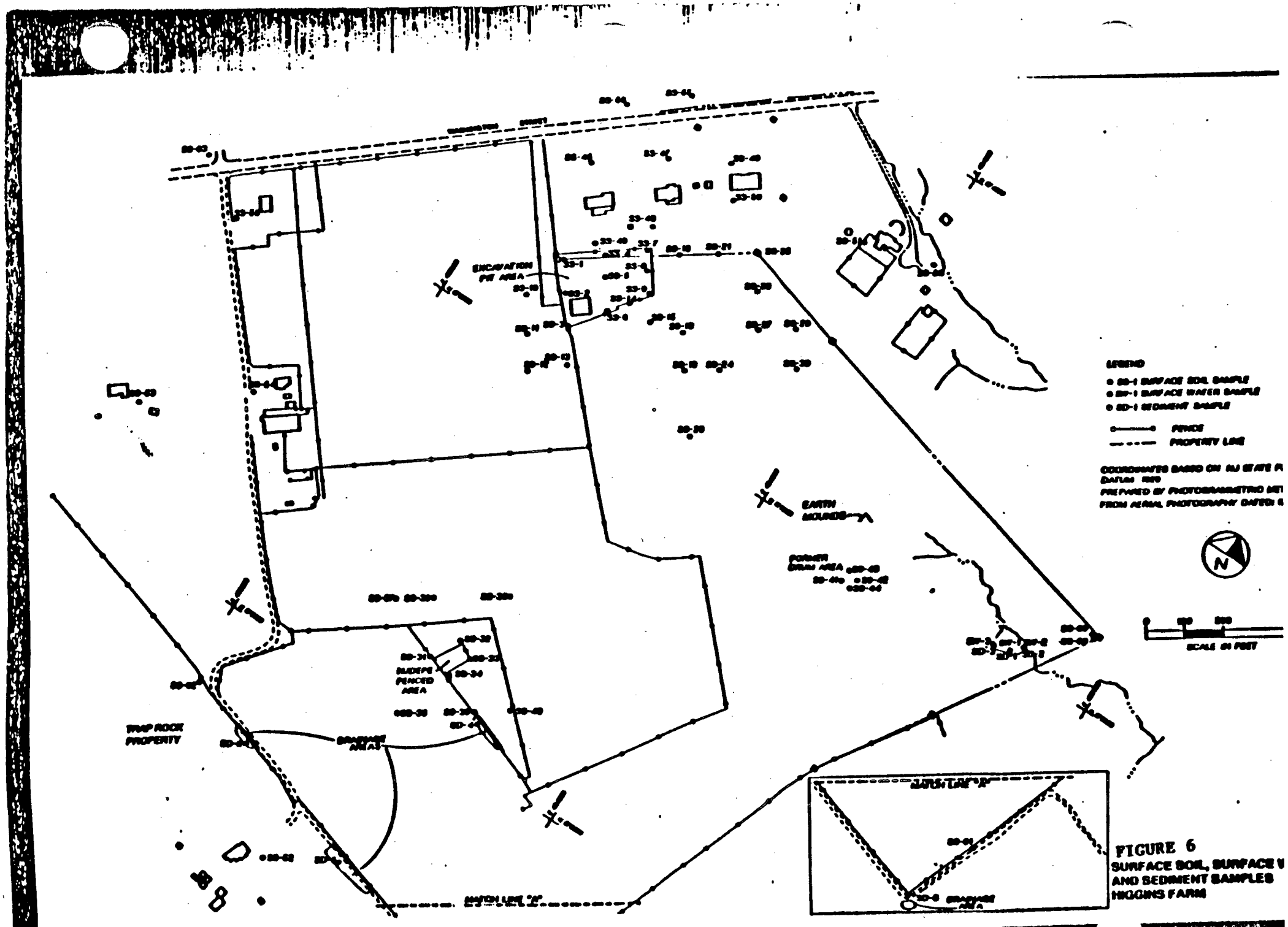


FIGURE 6
SURFACE SOIL, SURFACE W
AND SEDIMENT SAMPLES
HIGGINS FARM

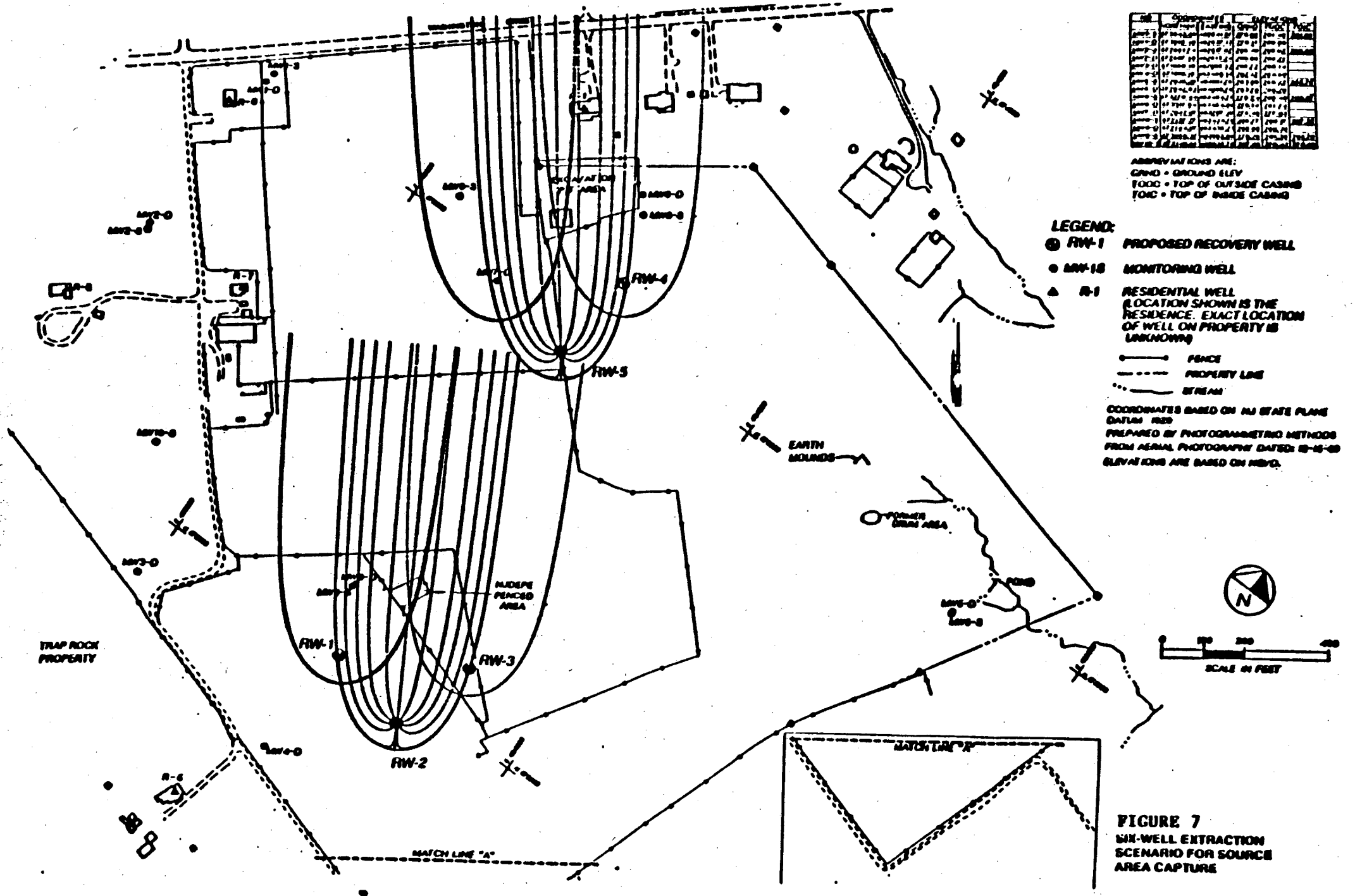


FIGURE 7
SIX-WELL EXTRACTION SCENARIO FOR SOURCE AREA CAPTURE

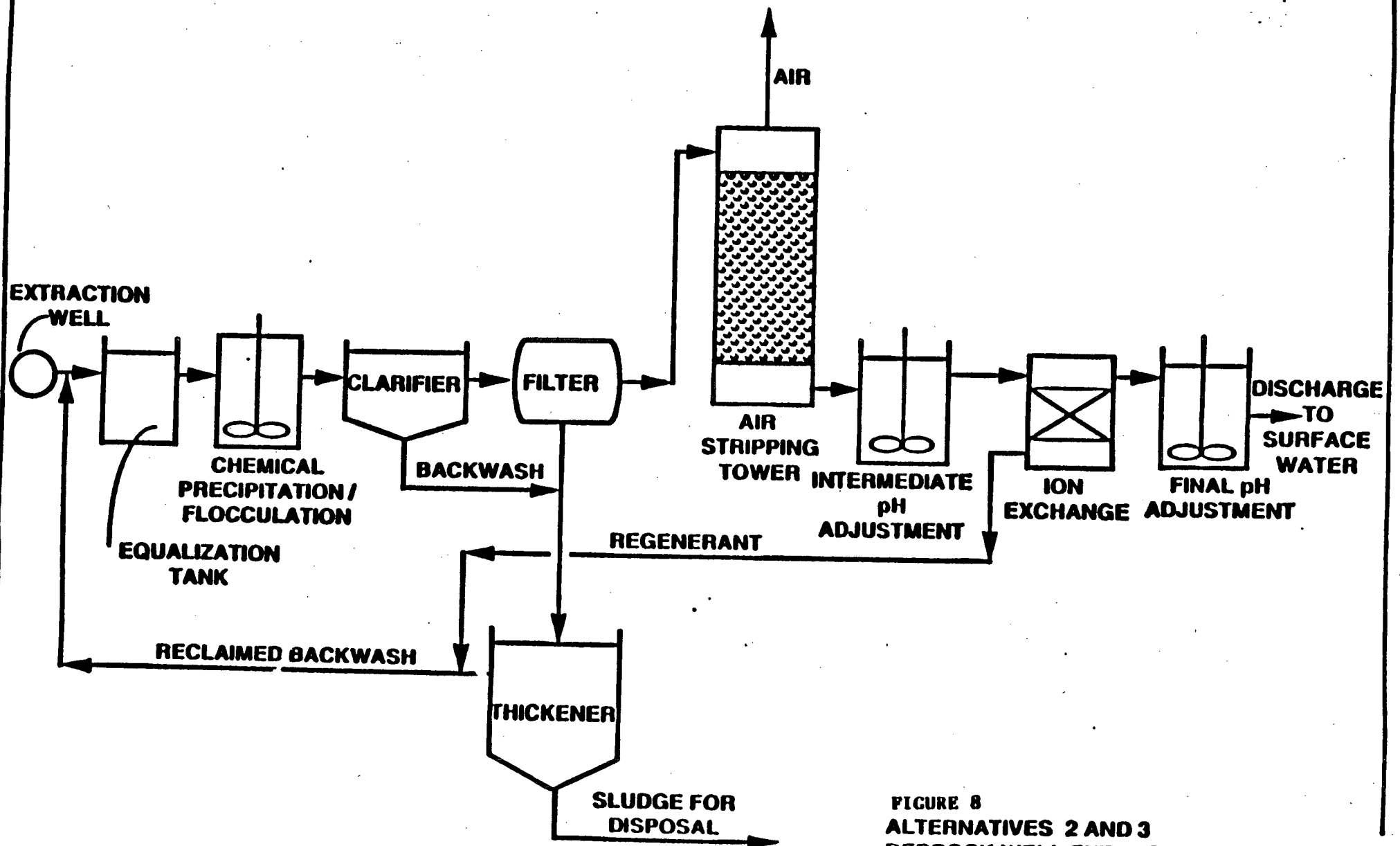


FIGURE 8
ALTERNATIVES 2 AND 3
BEDROCK WELL EXTRACTION,
METALS PRECIPITATION,
AERATION, AND ION EXCHANGE
HIGGINS FARM

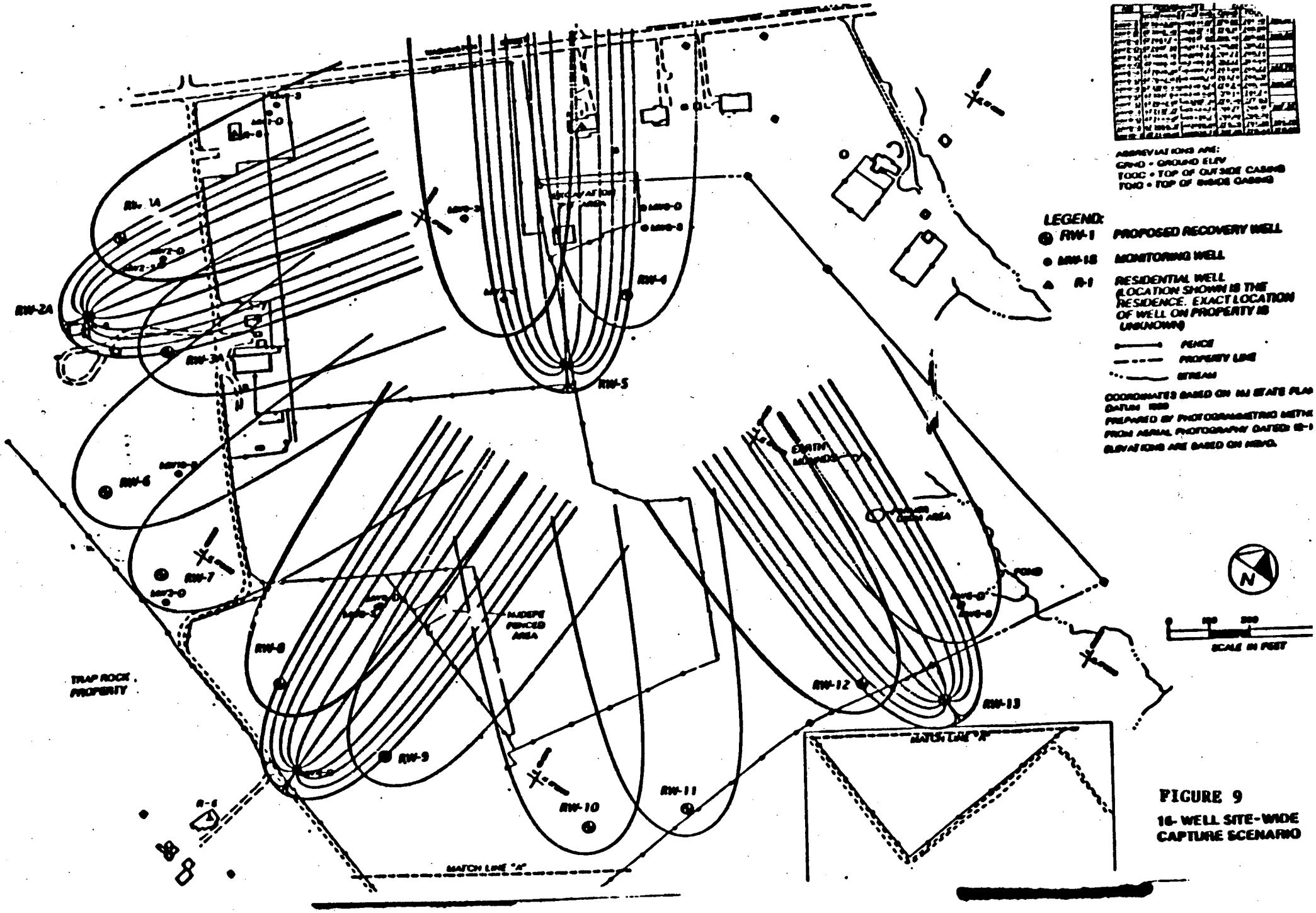


FIGURE 9
16-WELL SITE-WIDE CAPTURE SCENARIO

APPENDIX II

TABLES

TABLE 1

RI Objectives and Associated Tasks

Objective	RI Task
Identify source areas	• Surface geophysics • Soil gas survey • Test pits
Define contamination of soils, surface water, and sediment	• Topographic survey of site • Soil gas survey • Sample collection from surface soil, surface water, and sediment • Subsurface soil sample collection through soil borings and during well installation • Test pits
Characterize site hydrogeology and ground water contamination	• Fracture trace analysis • Soil borings • Borehole geophysics • Monitoring well installation • Packer testing • Sample collection from monitoring wells and residential wells
Identify cultural resources	• Stage 1-A historical survey
Determine risks to humans/ environment	• Human health and environmental assessment

TABLE 3
Comparison of Test Pit Results to Proposed NJDEPE Standards and EPA Risk-Based Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Residential Subsurface Soil)	EPA Risk-Based Standard[a]
VOLATILE ORGANICS				
TP-000X	1,2-Dichloroethane	30.00 ppb	6,000 pp : 7,000 ppb)	7,000 ppb
TP-002	1,1,2,2-Tetrachloroethane	56.00 ppb	1,000 ppb	3,145 ppb
TP-000X	1,1,2-Trichloroethane	4,400.00 ppb	1,000 ppb	11,100 ppb
TP-000YD	Acetone[b]	8,600.00 ppb	1,900,000 ppb (50,000 ppb)	26,988,000 ppb
TP-000X	Chloroform	15.00 ppb	19,000 ppb (1,000 ppb)	105,000 ppb
TP-000X	Tetrachloroethene	47,000.00 ppb	1,000 ppb	12,210 ppb
TP-000X	Carbon tetrachloride	2.00 ppb	2,000 ppb 7,000 ppb)	4,920 ppb
TP-000X	Trichloroethene	1,900.00 ppb	–	55,500 ppb
TP-000X	1,2-Dichloroethene (total)	55.00 ppb	,9,000 ppb (50,000 ppb)	4,050,000 ppb
TP-000X	Toluene	63.00 ppb	1,000,000 ppb (500,000 ppb)	553,600,000 ppb
SEMIVOLATILE ORGANICS				
TP-001	1,2-Dichlorobenzene[c]	240.00 ppb	5,100,000 ppb	24,220,000 ppb
TP-000O	Benzoic acid[b]	6,700.00 ppb	– (–)	–
TP-000G	Bis(2-ethylhexyl)phthalate	490.00 ppb	100,000 ppb	44,400 ppb
TP-000A	Fluoranthene	170.00 ppb	500,000 ppb	10,726,000 ppb
TP-000O	Pentachlorophenol[b]	2,100,000.00 ppb	1,700,000 ppb (100,000) ppb	5,180 ppb
TP-000A	Phenanthrene	190.00 ppb	–	–
TP-000O	Phenol[b]	99.00 ppb	10,000,000 ppb	162,620,000 ppb
TP-000A	Pyrene	130.00 ppb	500,000 ppb	12,456 ppb
PESTICIDES/PCBs				
TP-000O	4,4'-DDT[b]	43.0 ppb	2,000 ppb (100,000 ppb)	1,850 ppb
TP-001	Heptachlor[c]	24.0 ppb	150 ppb	140.6 ppb
TP-001	Heptachlor epoxide[c]	11.0 ppb	–	–
DIOXINS/FURANS				
TP-000O	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	138.179 ppb	–	–
TP-000O	1,2,3,4,6,7,8-Heptachlorodibenzofuran	63.400 ppb	–	–
TP-000O	1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.400 ppb	–	–
TP-000K	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.558 ppb	–	–
TP-000YD	1,2,3,4,7,8-Hexachlorodibenzofuran	1.359 ppb	–	–

TABLE 3
Comparison of Test Pit Results to Proposed NJDEPE Standards and EPA Risk-Based Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Residential Subsurface Soil)	EPA Risk-Based Standard[a]
TP-000O	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	5.371 ppb	—	—
TP-000Y	1,2,3,7,8-Pentachlorodibenzofuran	0.434 ppb	—	—
TP-000Y	2,3,4,6,7,8-Hexachlorodibenzofuran	0.422 ppb	—	—
TP-000O	Total-Heptachlorodibenzo-p-dioxin	208.643 ppb	—	—
TP-000O	Total-Heptachlorodibenzofuran	247.224 ppb	—	—
TP-000O	Total-Hexachlorodibenzo-p-dioxin	14.523 ppb	—	—
TP-000O	Total-Hexachlorodibenzofuran	121.069 ppb	—	—
TP-000O	Total-Octachlorodibenzo-p-dioxin	197.015 ppb	—	—
TP-000O	Total-Octachlorodibenzofuran	116.145 ppb	—	—
TP-000O	Total-Pentachlorodibenzofuran	5.354 ppb	—	—
INORGANICS				
TP-003	Aluminum	41,800.00 ppm	—	—
TP-000O	Antimony[b]	13.00 ppm	14 ppm (—)	107.26 ppm
TP-001	Arsenic[c]	1,310.00 ppm	20 ppm	0.3589 ppm
TP-00OX	Barium[b]	212.00 ppm	500 ppm (—)	19,030 ppm
TP-000F	Beryllium	4.00 ppm	—	0.148 ppm
TP-000X	Cadmium[b]	0.79 ppm	1 ppm (—)	135 ppm
TP-000A	Calcium	2,150.00 ppm	—	—
TP-000O	Chromium[b,d]	3,700.00 ppm	— (—)	1,350 ppm(VI) 270,000 ppm(III)
TP-000F	Cobalt	210.00 ppm	—	—
TP-003	Copper	295.00 ppm	—	10,034 ppm
TP-001	Cyanide[c]	2.20 ppm	280 ppm	5,500 ppm
TP-003	Iron	102,000.00 ppm	—	—
TP-000A	Lead	32.90 ppm	—	500 ppm
TP-000X	Magnesium[b]	10,700.00 ppm	— (—)	—
TP-000F	Manganese	2,330.00 ppm	—	—
TP-003	Nickel	35.30 ppm	—	592 ppm
TP-000X	Potassium[b]	2,480.00 ppm	— (—)	—
TP-000Y	Silver[b]	2.60 ppm	40 ppm (—)	1,349.4 ppm

TABLE 3

Comparison of Test Pit Results to Proposed NJDEPE Standards and EPA Risk-Based Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Residential Subsurface Soil)	EPA Risk-Based Standard[a]
TP-000Y	Sodium[b]	3,890.00 ppm	— (—)	—
TP-002	Vanadium	742.00 ppm	—	1,903 ppm
TP-002	Zinc	106.00 ppm	—	55,360 ppm

[a]OSWER Directive 9285.7-01B, Human Health Evaluation Part B: Development of Risk-Based Preliminary Remediation Goals, December 13, 1991.

[b]These pit samples were obtained at a depth of 1-3 feet. The NJDEPE proposed surface soil cleanup standards are applicable from a depth of 0-2 feet, whereas the subsurface soil standards are applicable from a depth of 2-4 feet. Due to the depth range of 1-3 feet, which overlaps depth ranges, both the surface and subsurface standards are presented. The subsurface standards are in parentheses.

[c]The test pit was sampled at a depth between 0 and 2 feet and the existing surface soil standards were provided in these instances.

[d]Although test pit results are for total chromium, an exceedance is shown to be conservative. There are no results for the individual chromium species chromium VI and chromium III.

Note: "—" = Standard does not exist for this compound

= Standards have been exceeded

TABLE 5
Comparison of Soil Boring Results to Proposed NJDEPE Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Subsurface Soil)
VOLATILE ORGANICS			
SB-013	1,1,2-Trichloroethane	74.00 ppb	1,000 ppb
SB-006	1,2-Dichloroethane	0.50 ppb	1,000 ppb
SB-012	2-Butanone	2.00 ppb	50,000 ppb
SB-012	Acetone	49.00 ppb	50,000 ppb
SB-006	Benzene	69.00 ppb	1,000 ppb
SB-006	Chloroform	210.00 ppb	1,000 ppb
SB-004	Methylene chloride	9.00 ppb	10,000 ppb
SB-011	Tetrachloroethene	1,100.00 ppb	1,000 ppb
SB-005	Trichloroethene	4.00 ppb	—
SEMIVOLATILE ORGANICS			
SB-001	Benzyl butyl phthalate	1,100.00 ppb	100,000 ppb
SB-003	Bis(2-ethylhexyl)phthalate	1,400.00 ppb	100,000 ppb
PESTICIDES/PCBs			
SB-013	Aroclor-1260 (PCB)	5.20 ppb	100,000 ppb
DIOXINS/FURANS			
SB-003	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.230 ppb	—
SB-001	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.009 ppb	—
SB-001	1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.008 ppb	—
SB-013	1,2,3,4,7,8-Hexachlorodibenzofuran	0.030 ppb	—
SB-013	1,2,3,6,7,8-Hexachlorodibenzofuran	0.030 ppb	—
SB-001	1,2,3,7,8,9-Hexachlorodibenzofuran	0.003 ppb	—
SB-001	1,2,3,7,8-Pentachlorodibenzofuran	0.005 ppb	—
SB-013	2,3,4,6,7,8-Hexachlorodibenzofuran	0.020 ppb	—
SB-013	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.030 ppb	—
SB-013	2,3,7,8-Tetrachlorodibenzofuran	0.020 ppb	—

TABLE 5
Comparison of Soil Boring Results to Proposed NJDEPE Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Subsurface Soil)
SB-003	Octachlorodibenzo-p-dioxin	76.00 ppb	—
SB-001	Octachlorodibenzofuran	0.009 ppb	—
SB-003	Total-Heptachlorodibenzo-p-dioxin	0.480 ppb	—
SB-001	Total-Heptachlorodibenzofuran	0.010 ppb	—
SB-006	Total-Hexachlorodibenzo-p-dioxin	0.070 ppb	—
SB-013	Total-Hexachlorodibenzofuran	0.080 ppb	—
SB-006	Total-Pentachlorodibenzofuran	0.006 ppb	—
SB-006	Total-Tetrachlorodibenzo-p-dioxin	0.550 ppb	—
SB-006	Total-Tetrachlorodibenzofuran	0.030 ppb	—
METALS			
SB-003	Aluminum	54,100.00 ppm	—
SB-008	Antimony	12.70 ppm	—
SB-006	Arsenic	21.10 ppm	—
SB-002	Barium	298.00 ppm	—
SB-008	Beryllium	11.60 ppm	—
SB-004	Cadmium	1.30 ppm	—
SB-006	Calcium	9,680.00 ppm	—
SB-001	Chromium	21.80 ppm	—
SB-013	Cobalt	97.00 ppm	—
SB-006	Copper	1,830.00 ppm	—
SB-013D	Iron	136,000.00 ppm	—
SB-010	Lead	17.10 ppm	—
SB-013	Magnesium	8,490.00 ppm	—
SB-004	Manganese	922.00 ppm	—
SB-004	Mercury	0.10 ppm	—
SB-002	Nickel	47.40 ppm	—

TABLE 5
Comparison of Soil Boring Results to Proposed NJDEPE Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Subsurface Soil)
SB-009	Potassium	2,760.00 ppm	—
SB-001	Selenium	0.48 ppm	—
SB-003	Silver	18.40 ppm	—
SB-002	Sodium	257.00 ppm	—
SB-011	Thallium	0.91 ppm	—
SB-003	Vanadium	551.00 ppm	—
SB-013	Zinc	251.00 ppm	—

Note: "—" = Standard does not exist for this compound

= Standards have been exceeded

TABLE 6

Comparison of Sediment Sample Results to Proposed NJDEPE Standards and EPA Risk-Based Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Residential Surface Soil)	EPA Risk-Based Standard*
SD-008	Total-Heptachlorodibenzo-p-dioxin	2.100 ppb	—	—
SD-008	Total-Hexachlorodibenzo-p-dioxin	0.180 ppb	—	—
SD-008	Total-Pentachlorodibenzo-p-dioxin	0.060 ppb	—	—
SD-006	Total-Tetrachlorodibenzo-p-dioxin	0.080 ppb	—	—
INORGANICS				
SD-003	Aluminum*	24,700.000 ppm	—	—
SD-003	Antimony*	11.80 ppm	14 ppm	107.26 ppm
SD-004	Arsenic	5.70 ppm	20 ppm	0.3569 ppm
SD-003	Barium*	129.00 ppm	500 ppm	19,030 ppm
SD-005	Beryllium	2.00 ppm	2 ppm	0.146 ppm
SD-006	Calcium	4,280.00 ppm	—	—
SD-002	Chromium*	14.70 ppm	—	—
SD-006	Cobalt	46.90 ppm	—	—
SD-003	Copper*	163.00 ppm	600 ppm	10,034 ppm
SD-003	Iron*	67,600.00 ppm	—	—
SD-004	Lead	74.50 ppm	100 ppm	500 ppm
SD-001	Magnesium*	1,330.00 ppm	—	—
SD-008	Manganese	518.00 ppm	—	—
SD-004	Mercury	0.22 ppm	14 ppm	79.58 ppm
SD-003	Nickel*	16.50 ppm	250 ppm	592 ppm
SD-004	Potassium	810.00 ppm	—	—
SD-008	Selenium	1.60 ppm	60 ppm	1,349.4 ppm
SD-002	Sodium*	137.00 ppm	—	—
SD-003	Vanadium*	224.00 ppm	380 ppm	1,903 ppm
SD-004	Zinc	94.70 ppm	1,500 ppm	55,360 ppm

*OSWER Directive 9285.7-01B, Human Health Evaluation Part B: Development of Risk-Based Preliminary Remediation Goals, December 13, 1991.

Note: "—" = Standard does not exist for this compound

= Standards have been exceeded

••• = Sediment sample taken from pond

TABLE 6
Comparison of Sediment Sample Results to Proposed NJDEPE Standards and EPA Risk-Based Standards

Station ID	Compound	Highest Detected Concentration	NJDEPE Proposed Soil Cleanup Standard (Residential Surface Soil)	EPA Risk-Based Standard[a]
VOLATILE ORGANICS				
SD-002	2-Butanone*	13.00 ppb	1,000,000 ppb	13,494,000 ppb
SD-006	Chloromethane	4.00 ppb	520,000 ppb	48,100 ppb
SD-006	Toluene	3.00 ppb	1,000,000 ppb	553,600,000 ppb
SEMIVOLATILE ORGANICS				
SD-004	2-Methylnaphthalene	80.00 ppb	—	—
SD-004	4-Methylphenol	660.00 ppb	—	—
SD-004	Acenaphthylene	37.00 ppb	3,400,000 ppb	16,500,000 ppb
SD-004	Anthracene	110.00 ppb	10,000,000 ppb	79,580,000 ppb
SD-004	Benzo(a)anthracene	580.00 ppb	660 ppb	740 ppb
SD-004	Benzo(a)pyrene	500.00 ppb	660 ppb	107.3 ppb
SD-004	Benzo(b)fluoranthene	830.00 ppb	660 ppb	777 ppb
SD-004	Benzo(ghi)perylene	320.00 ppb	660 ppb	4,810 ppb
SD-004	Benzo(k)fluoranthene	430.00 ppb	660 ppb	1,628 ppb
SD-003	Benzoic acid*	230.00 ppb	—	—
SD-004	Bis(2-ethylhexyl)phthalate	540.00 ppb	49,000 ppb	44,400 ppb
SD-004	Chrysene	950.00 ppb	660 ppb	24,790 ppb
SD-003	Di-n-butyl-phthalate*	25.00 ppb	5,700,000 ppb	26,988,000 ppb
SD-004	Dibenzofuran	84.00 ppb	—	—
SD-008	Diethyl phthalate	140.00 ppb	10,000,000 ppb	217,980,000 ppb
SD-004	Fluoranthene	900.00 ppb	2,300,000 ppb	10,726,000 ppb
SD-004	Indeno(1,2,3-CD)pyrene	390.00 ppb	660 ppb	481 ppb
SD-004	Naphthalene	79.00 ppb	230,000 ppb	11,000,000 ppb
SD-004	Phenanthrene	440.00 ppb	—	—
SD-004	Pyrene	950.00 ppb	1,700,000 ppb	12,456 ppb
DIOXINS/FURANS				
SD-008	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	8.740 ppb	—	—
SD-008	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.120 ppb	—	—
SD-008	Octachlorodibenzo-p-dioxin	107.000 ppb	—	—
SD-008	Total-Heptachlorodibenzo-p-dioxin	2.100 ppb	—	—

TABLE 7

CHEMICALS OF POTENTIAL CONCERN: FINAL SELECTION LIST

HIGGINS FARM

CHEMICAL	GROUND WATER	SURFACE SOIL	SURFACE WATER	SEDIMENT
VOLATILES				
Benzene	X	•	ND	ND
Chlorobenzene	X	•	ND	ND
Chloroform	X	ND	ND	ND
1,2-Dichlorobenzene	X	ND	ND	ND
1,1-Dichloroethane	X	ND	ND	ND
1,2-Dichloroethane	X	ND	ND	ND
1,1-Dichloroethene	X	ND	ND	ND
1,2-Dichloroethene	X	ND	ND	ND
Isopropylbenzene	X	ND	ND	ND
1,1,2,2-Tetrachloroethane	X	ND	ND	ND
Tetrachloroethene	X	•	ND	ND
1,2,4-Trichlorobenzene	X	ND	ND	ND
1,1,2-Trichloroethane	X	ND	ND	ND
Trichloroethene	X	•	ND	ND
Vinyl Chloride	X	ND	ND	ND
Xylenes (total)	X	•	ND	ND
SEMI-VOLATILES				
Bis(2-chloroethyl)ether	X	ND	ND	ND
Bis(2-ethylhexyl)phthalate	•	X	•	X
Di-n-butylphthalate	•	X	•	X
Diethylphthalate	•	X	•	X
DIOXINS/FURANS				
PCDD/PCDFs	NA	X	NA	X
INORGANICS				
Arsenic	ND	X	ND	X
Beryllium	ND	X	ND	X

TABLE 7

CHEMICALS OF POTENTIAL CONCERN: FINAL SELECTION LIST

HIGGINS FARM

CHEMICAL	GROUND WATER	SURFACE SOIL	SURFACE WATER	SEDIMENT
Lead	•	X	)	X
Mercury	ND	X	ND	X

Notes:

X = selected as a chemical of potential concern.
ND = Not Detected.
• = Detected, but not selected as a chemical of potential concern.
NA = Not Analyzed.

TABLE 8

SUMMARY OF COMPLETE EXPOSURE PATHWAYS

HIGGINS FARM

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Use			
Residents	Ingestion of and dermal contact with chemicals of potential concern in soil.	Yes	Contaminated soil is in an area potentially used by residents.
Residents	Ingestion of, dermal contact with, and inhalation of chemicals of potential concern in ground water.	Yes	Residents use ground water for drinking, bathing, cleaning and other home uses.
Workers	Ingestion of and dermal contact with chemicals of potential concern in soil.	Yes	Contaminated soil is in an area potentially used by workers.
Trespassers	Ingestion of and dermal contact with chemicals of potential concern in soil.	Yes	Contaminated soil may be encountered by trespassers.
Trespassers	Dermal contact with chemicals of potential concern in sediment.	Yes	Contaminated sediment may be encountered by trespassers.
Trespassers	Ingestion of and dermal contact with chemicals of potential concern in surface water.	No	No chemicals of potential concern have been identified in surface water.

TABLE 9

SUMMARY OF COMPLETE EXPOSURE PATHWAYS

HIGGINS FARM

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Future Land Use			
Residents	Ingestion of and dermal contact with chemicals of potential concern in soil.	No	While the site could be developed in the future as a residential area, the estimated exposures would be unlikely to exceed those estimated in the current use scenario.
Residents	Dermal contact with chemicals of potential concern in sediment.	Yes	A resident my have opportunity to contact sediment during recreational activities for a longer duration than a trespasser if the site were developed in the future as a residential area.
Consumers	Ingestion of farm products and produce.	No	While its plausible that the site could be developed in the future for livestock and/or agricultural product production, it is unlikely that such development would occur.

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
CURRENT LAND USE						
ADOLESCENT TRESPASSERS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	4.88E-08	NO	2.00E-02	3.44E-06	
	diethylphthalate	4.04E-08	—	—	—	
	di-n-butylphthalate	3.80E-08	NO	1.00E+00	3.80E-08	
	PCDDs/PCDFs	4.75E-12	—	—	—	
	arsenic	1.12E-06	NO	3.00E-04	3.73E-03	
	beryllium	3.32E-07	NO	5.00E-03	6.64E-05	
	lead	4.92E-06	—	—	—	
	mercury	1.80E-08	NO	3.00E-04	6.00E-05	3.86E-03
Dermal contact	bis(2-ethylhexyl)phthalate	4.11E-07	YES	2.00E-02	2.06E-05	
	diethylphthalate	2.41E-07	—	—	—	
	di-n-butylphthalate	2.27E-07	YES	1.00E+00	2.27E-07	
	PCDDs/PCDFs	2.84E-11	—	—	—	
	arsenic	1.33E-06	YES	2.40E-04	5.54E-03	
	beryllium	3.97E-07	YES	5.00E-05	7.94E-03	
	lead	5.96E-06	—	—	—	
	mercury	2.16E-08	YES	6.00E-06	3.60E-03	1.71E-02
ADOLESCENT TRESPASSERS: Dermal contact with chemicals in sediment						
	bis(2-ethylhexyl)phthalate	5.32E-07	YES	2.00E-02	2.66E-05	
	diethylphthalate	1.99E-07	—	—	—	
	di-n-butylphthalate	3.55E-08	YES	1.00E+00	3.55E-08	
	PCDDs/PCDFs	1.84E-10	—	—	—	
	arsenic	1.55E-06	YES	2.40E-04	6.46E-03	
	beryllium	5.19E-07	YES	5.00E-05	1.04E-02	
	lead	2.11E-05	—	—	—	
	mercury	6.24E-08	YES	6.00E-06	1.04E-02	2.73E-02
TOTAL EXPOSURE HAZARD INDEX FOR ADOLESCENT TRESPASSERS						4.82E-02

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = Adj RfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
CURRENT LAND USE						
RESIDENT ADULTS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	4.79E-07	NO	2.00E-02	2.40E-05	
	di-n-butylphthalate	4.11E-07	NO	1.00E-00	4.11E-07	
	PCDDs/PCDFs	5.48E-11	—	—	—	
	arsenic	6.58E-06	NO	3.00E-04	2.19E-02	
	beryllium	1.51E-06	NO	5.00E-03	3.02E-04	
	lead	1.64E-04	—	—	—	
	mercury	5.21E-07	NO	3.00E-04	1.74E-03	2.40E-02
Dermal contact	bis(2-ethylhexyl)phthalate	2.85E-07	YES	2.00E-02	1.43E-05	
	di-n-butylphthalate	2.44E-07	YES	1.00E-00	2.44E-07	
	PCDDs/PCDFs	3.26E-11	—	—	—	
	arsenic	7.82E-07	YES	2.40E-04	3.26E-03	
	beryllium	1.79E-07	YES	5.00E-05	3.58E-03	
	lead	1.95E-05	—	—	—	
	mercury	6.19E-08	YES	6.00E-06	1.03E-02	1.72E-02
RESIDENT ADULTS: Ingestion, dermal contact and inhalation of chemicals in ground water						
Ingestion	bis(2-chloroethyl)ether	5.71E-05	—	—	—	
	benzene	3.43E-02	—	—	—	
	chlorobenzene	3.14E-02	NO	2.00E-02	1.57E-00	
	chloroform	2.84E-04	NO	1.00E-02	2.84E-02	
	1,2-dichlorobenzene	1.08E-03	NO	9.00E-02	1.20E-02	
	1,1-dichloroethane	4.43E-05	NO	1.00E-01	4.43E-04	
	1,2-dichloroethane	4.60E-03	—	—	—	
	1,1-dichloroethene	1.25E-04	NO	9.00E-03	1.39E-02	
	1,2-dichloroethene	1.88E-03	NO	2.00E-02	9.40E-02	
	isopropyl benzene	4.29E-05	NO	4.00E-02	1.07E-03	
	1,1,2,2-tetrachloroethane	4.23E-05	—	—	—	
	tetrachloroethene	7.71E-03	NO	1.00E-02	7.71E-01	
	1,2,4-trichlorobenzene	4.86E-05	NO	1.30E-03	3.74E-02	
	1,1,2-trichloroethane	3.14E-02	NO	4.00E-03	7.85E-00	
	trichloroethene	6.29E-03	—	—	—	
	vinyl chloride	4.29E-04	—	—	—	
	xylenes (total)	1.08E-04	NO	2.00E-00	5.40E-05	1.04E-01

NOTE *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = Adj RfD

When ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
Dermal contact	bis(2-chloroethyl)ether	2.00E-06	—	—	—	
	benzene	4.46E-03	—	—	—	
	chlorobenzene	2.00E-02	YES	2.00E-02	1.00E+00	
	chloroform	2.44E-05	YES	1.00E-02	2.44E-03	
	1,2-dichlorobenzene	9.94E-05	YES	9.00E-02	1.10E-03	
	1,1-dichloroethane	2.51E-06	YES	1.00E-01	2.51E-05	
	1,2-dichloroethane	4.23E-03	—	—	—	
	1,1-dichloroethene	1.55E-05	YES	9.00E-03	1.72E-03	
	1,2-dichloroethene	5.22E-05	YES	2.00E-02	2.61E-03	
	isopropyl benzene	3.94E-05	YES	4.00E-02	9.85E-04	
	1,1,2,2-tetrachloroethane	9.55E-08	—	—	—	
	tetrachloroethene	5.39E-05	YES	1.00E-02	5.39E-03	
	1,2,4-trichlorobenzene	3.24E-06	YES	1.30E-03	2.49E-03	
	1,1,2-trichloroethane	7.61E-03	YES	4.00E-03	1.90E+00	
	trichloroethene	1.52E-03	—	—	—	
	vinyl chloride	9.03E-06	—	—	—	
	xylenes (total)	9.94E-05	YES	2.00E+00	4.97E-05	2.92E+00
Inhalation	bis(2-chloroethyl)ether	2.29E-05	—	—	—	
	benzene	1.37E-02	—	—	—	
	chlorobenzene	1.26E-02	NO	5.00E-03	2.52E+00	
	chloroform	1.14E-04	—	—	—	
	1,2-dichlorobenzene	4.32E-04	NO	4.00E-02	1.08E-02	
	1,1-dichloroethane	1.77E-05	NO	1.00E-01	1.77E-04	
	1,2-dichloroethane	1.84E-03	—	—	—	
	1,1-dichloroethene	5.01E-05	—	—	—	
	1,2-dichloroethene	7.51E-04	—	—	—	
	isopropyl benzene	1.71E-05	—	—	—	
	1,1,2,2-tetrachloroethane	1.69E-05	—	—	—	
	tetrachloroethene	3.09E-03	—	—	—	
	1,2,4-trichlorobenzene	1.94E-05	NO	3.00E-03	6.47E-03	
	1,1,2-trichloroethane	1.26E-02	—	—	—	
	trichloroethene	2.51E-03	—	—	—	
	vinyl chloride	1.71E-04	—	—	—	
	xylenes (total)	4.32E-05	NO	8.60E-02	5.02E-04	2.54E+00
TOTAL EXPOSURE HAZARD INDEX FOR RESIDENT ADULTS						1.59E+01

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
CURRENT LAND USE						
RESIDENT CHILDREN: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	4.54E-06	NO	2.00E-02	2.27E-04	
	di-n-butylphthalate	3.89E-06	NO	1.00E+00	3.89E-06	
	PCDDs/PCDFs	5.18E-10	—	—	—	
	arsenic	6.22E-05	NO	3.00E-04	2.07E-01	
	beryllium	1.43E-05	NO	5.00E-03	2.86E-03	
	lead	1.55E-03	—	—	—	
	mercury	4.92E-06	NO	3.00E-04	1.64E-02	2.27E-01
Dermal contact	bis(2-ethylhexyl)phthalate	5.24E-06	YES	2.00E-02	2.62E-04	
	di-n-butylphthalate	4.50E-06	YES	1.00E+00	4.50E-06	
	PCDDs/PCDFs	5.99E-10	—	—	—	
	arsenic	1.44E-05	YES	2.40E-04	6.00E-02	
	beryllium	3.30E-06	YES	5.00E-05	6.60E-02	
	lead	3.60E-04	—	—	—	
	mercury	1.14E-06	YES	6.00E-06	1.90E-01	3.16E-01
RESIDENT CHILDREN: Ingestion, dermal contact and inhalation of chemicals in ground water						
Ingestion	bis(2-chloroethyl)ether	1.35E-04	—	—	—	
	benzene	8.11E-02	—	—	—	
	chlorobenzene	7.43E-02	NO	2.00E-02	3.72E+00	
	chloroform	6.72E-04	NO	1.00E-02	6.72E-02	
	1,2-dichlorobenzene	2.55E-03	NO	9.00E-02	2.83E-02	
	1,1-dichloroethane	1.05E-04	NO	1.00E-01	1.05E-03	
	1,2-dichloroethane	1.09E-03	—	—	—	
	1,1-dichloroethene	2.96E-04	NO	9.00E-03	3.29E-02	
	1,2-dichloroethene	4.44E-03	NO	2.00E-02	2.22E-01	
	isopropyl benzene	1.01E-04	NO	4.00E-02	2.53E-03	
	1,1,2,2-tetrachloroethane	1.00E-04	—	—	—	
	tetrachloroethene	1.82E-02	NO	1.00E-02	1.82E+00	
	1,2,4-trichlorobenzene	1.15E-04	NO	1.30E-03	8.85E-02	
	1,1,2-trichloroethane	7.43E-02	NO	4.00E-03	1.86E+01	
	trichloroethene	1.49E-02	—	—	—	
	vinyl chloride	1.01E-03	—	—	—	
	xylenes (total)	2.55E-04	NO	2.00E+00	1.28E-04	2.46E+01

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
Dermal exposure	bis(2-chloroethyl)ether	3.56E-06	—	—	—	
	benzene	7.94E-03	—	—	—	
	chlorobenzene	3.57E-02	YES	2.00E-02	1.79E+00	
	chloroform	4.35E-05	YES	1.00E-02	2.18E-03	
	1,2-dichlorobenzene	1.77E-04	YES	9.00E-02	1.97E-03	
	1,1-dichloroethane	4.48E-06	YES	1.00E-01	4.48E-05	
	1,2-dichloroethane	7.54E-03	—	—	—	
	1,1-dichloroethene	2.77E-05	YES	9.00E-03	3.08E-03	
	1,2-dichloroethene	9.30E-05	YES	2.00E-02	4.65E-03	
	isopropyl benzene	7.03E-05	YES	4.00E-02	1.76E-03	
	1,1,2,2-tetrachloroethane	1.07E-07	—	—	—	
	tetrachloroethene	9.60E-05	YES	1.00E-02	9.60E-03	
	1,2,4-trichlorobenzene	5.77E-06	YES	1.30E-03	4.44E-03	
	1,1,2-trichloroethane	1.36E-02	YES	4.00E-03	3.40E+00	
	trichloroethene	2.71E-03	—	—	—	
	vinyl chloride	1.61E-05	—	—	—	
	xylenes (total)	1.77E-04	YES	2.00E+00	8.85E-05	5.21E+00
Inhalation	bis(2-chloroethyl)ether	1.44E-04	—	—	—	
	benzene	8.65E-02	—	—	—	
	chlorobenzene	7.93E-02	NO	5.00E-03	1.59E+01	
	chloroform	7.16E-04	—	—	—	
	1,2-dichlorobenzene	2.72E-03	NO	4.00E-02	6.80E-02	
	1,1-dichloroethane	1.12E-04	NO	1.00E-01	1.12E-03	
	1,2-dichloroethane	1.16E-02	—	—	—	
	1,1-dichloroethene	3.16E-04	—	—	—	
	1,2-dichloroethene	4.74E-03	—	—	—	
	isopropyl benzene	1.08E-04	—	—	—	
	1,1,2,2-tetrachloroethane	1.07E-04	—	—	—	
	tetrachloroethene	1.95E-02	—	—	—	
	1,2,4-trichlorobenzene	1.23E-04	NO	3.00E-03	4.10E-02	
	1,1,2-trichloroethane	7.93E-02	—	—	—	
	trichloroethene	1.59E-02	—	—	—	
	vinyl chloride	1.08E-03	—	—	—	
	xylenes (total)	2.72E-04	NO	8.60E-02	3.16E-03	1.60E+01
TOTAL EXPOSURE HAZARD INDEX FOR RESIDENT CHILDREN						4.63E+01

NOTE: *RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1986)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
CURRENT LAND USE						
ADULT WORKERS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	2.84E-07	NO	2.00E-02	1.42E-05	
	diethylphthalate	1.66E-07	—	—	—	
	di-n-butylphthalate	1.57E-07	NO	1.00E+00	1.57E-07	
	PCDDs/PCDFs	1.96E-11	—	—	—	
	arsenic	4.60E-06	NO	3.00E-04	1.53E-02	
	beryllium	1.37E-06	NO	5.00E-03	2.74E-04	
	lead	2.05E-05	—	—	—	
	mercury	7.44E-08	NO	3.00E-04	2.48E-04	1.59E-02
Dermal contact	bis(2-ethylhexyl)phthalate	1.69E-07	YES	2.00E-02	8.45E-06	
	diethylphthalate	9.89E-07	—	—	—	
	di-n-butylphthalate	9.31E-08	YES	1.00E+00	9.31E-08	
	PCDDs/PCDFs	1.16E-11	—	—	—	
	arsenic	5.47E-07	YES	2.40E-04	2.28E-03	
	beryllium	1.63E-07	YES	5.00E-05	3.26E-03	
	lead	2.44E-06	—	—	—	
	mercury	8.84E-09	YES	6.00E-06	1.47E-03	7.02E-03
TOTAL EXPOSURE HAZARD INDEX FOR ADULT WORKERS						2.29E-02

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 10

SUMMARY OF CHRONIC NONCARCINOGENIC HAZARD INDEX ESTIMATES

HIGGINS FARM

Chemical	CDI (mg/kg-day)	RfD Adjusted for Absorption	RfD* (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
FUTURE LAND USE					
RESIDENT ADOLESCENTS: Dermal contact with chemicals in sediment					
bis(2-ethylhexyl)phthalate	5.92E-07	YES	2.00E-02	2.66E-05	
di-n-butylphthalate	[illegible]	YES	1.00E+00	3.55E-06	
PCDDs/PCDFs	1.84E-10	—	—	—	
arsenic	1.55E-06	YES	2.40E-04	6.46E-03	
beryllium	5.19E-07	YES	5.00E-05	1.04E-02	
lead	2.11E-05	—	—	—	
mercury	6.24E-08	YES	6.00E-06	1.04E-02	2.73E-02
TOTAL ADDITIONAL EXPOSURE HAZARD INDEX FOR RESIDENT ADOLESCENTS					2.73E-02

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
CURRENT LAND USE						
RESIDENT ADULTS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	2.05E-07	NO	1.40E-02	2.87E-09	
	PCDDs/PCDFs	2.35E-11	NO	1.50E+05	3.53E-06	
	arsenic	2.82E-06	NO	1.80E+00	5.08E-06	
	beryllium	6.46E-07	NO	4.30E+00	2.78E-06	1.14E-05
Dermal contact	bis(2-ethylhexyl)phthalate	1.22E-07	YES	1.40E-02	1.71E-09	
	PCDDs/PCDFs	1.40E-11	YES	1.50E+05	2.10E-06	
	arsenic	3.35E-07	YES	2.25E+00	7.54E-07	
	beryllium	7.68E-08	YES	4.30E-02	3.30E-05	3.59E-05
RESIDENT ADULTS: Ingestion, dermal contact and inhalation of chemicals in ground water						
Ingestion	benzene	1.47E-02	NO	2.90E-02	4.26E-04	
	bis(2-chloroethyl)ether	2.45E-05	NO	1.10E+00	2.70E-05	
	chloroform	1.22E-04	NO	6.10E-03	7.44E-07	
	1,1-dichloroethane	1.90E-05	—	—	—	
	1,2-dichloroethane	1.97E-03	NO	9.10E-02	1.79E-04	
	1,1-dichloroethene	5.36E-05	NO	6.00E-01	3.22E-05	
	1,1,2,2-tetrachloroethane	1.81E-05	NO	2.00E-01	3.62E-06	
	tetrachloroethene	3.31E-03	NO	5.10E-02	1.69E-04	
	1,1,2-trichloroethane	1.35E-02	NO	5.70E-02	7.70E-04	
	trichloroethene	2.69E-03	NO	1.10E-02	2.96E-05	
	vinyl chloride	1.84E-04	NO	1.90E+00	3.50E-04	1.99E-03

NOTE: RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = Adj RfD

Where ABS = 1.0 for organic chemicals (default value)
0.8 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
Dermal contact	benzene	1.91E-03	YES	2.90E-02	5.54E-05	
	bis(2-chloroethyl)ether	3.57E-07	YES	1.10E+00	9.43E-07	
	chloroform	1.05E-05	YES	6.10E-03	6.41E-08	
	1,1-dichloroethane	1.08E-06	—	—	—	
	1,2-dichloroethane	1.81E-03	YES	9.10E-02	1.65E-04	
	1,1-dichloroethene	6.66E-06	YES	6.00E-01	4.00E-06	
	1,1,2,2-tetrachloroethane	4.09E-08	YES	2.00E-01	8.18E-09	
	tetrachloroethene	2.31E-05	YES	5.10E-02	1.18E-06	
	1,1,2-trichloroethane	3.26E-03	YES	5.70E-02	1.86E-04	
	trichloroethene	6.52E-04	YES	1.10E-02	7.17E-06	
	vinyl chloride	3.87E-06	YES	1.90E+00	7.35E-06	4.27E-04
Inhalation	benzene	5.88E-03	NO	2.90E-02	1.71E-04	
	bis(2-chloroethyl)ether	9.80E-06	NO	1.15E+00	1.13E-05	
	chloroform	4.87E-05	NO	8.50E-02	4.14E-06	
	1,1-dichloroethane	7.59E-06	—	—	—	
	1,2-dichloroethane	7.89E-04	NO	9.10E-02	7.18E-05	
	1,1-dichloroethene	2.15E-05	NO	1.20E+00	2.58E-05	
	1,1,2,2-tetrachloroethane	7.25E-06	NO	2.00E-01	1.45E-06	
	tetrachloroethene	1.32E-03	NO	1.80E-03	2.38E-06	
	1,1,2-trichloroethane	5.39E-03	NO	5.70E-02	3.07E-04	
	trichloroethene	1.08E-03	NO	1.70E-02	1.84E-05	
	vinyl chloride	7.35E-05	NO	2.90E-01	2.13E-05	6.34E-04
TOTAL EXPOSURE RISK RESIDENT ADULTS						3.09E-03

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1986)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
CURRENT LAND USE						
RESIDENT CHILDREN: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	4.54E-07	NO	1.40E-02	6.36E-09	
	PCDDs/PCDFs	5.18E-11	NO	1.50E+05	7.77E-06	
	arsenic	6.22E-06	NO	1.80E+00	1.12E-05	
	beryllium	1.43E-06	NO	4.30E+00	6.15E-06	2.51E-05
Dermal contact	bis(2-ethylhexyl)phthalate	5.24E-07	YES	1.40E-02	7.34E-09	
	PCDDs/PCDFs	5.99E-11	YES	1.50E+05	8.99E-06	
	arsenic	1.44E-06	YES	2.25E+00	3.24E-06	
	beryllium	3.30E-07	YES	4.30E+02	1.42E-04	1.54E-04
RESIDENT CHILDREN: Ingestion, dermal contact and inhalation of chemicals in ground water						
Ingestion	benzene	8.11E-03	NO	2.90E-02	2.35E-04	
	bis(2-chloroethyl)ether	1.35E-05	NO	1.10E+00	1.49E-05	
	chloroform	6.72E-05	NO	6.10E-03	4.10E-07	
	1,1-dichloroethane	1.05E-05	—	—	—	
	1,2-dichloroethane	1.09E-03	NO	9.10E-02	9.92E-05	
	1,1-dichloroethene	2.96E-05	NO	6.00E-01	1.78E-05	
	1,1,2,2-tetrachloroethane	1.00E-05	NO	2.00E-01	2.00E-06	
	tetrachloroethene	1.82E-03	NO	5.10E-02	9.28E-05	
	1,1,2-trichloroethane	7.43E-03	NO	5.70E-02	4.24E-04	
	trichloroethene	1.49E-03	NO	1.10E-02	1.64E-05	
	vinyl chloride	1.01E-04	NO	1.90E+00	1.92E-04	1.09E-03

NOTE: *RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = Adj(RfD

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
Dermal contact	benzene	7.94E-04	YES	2.90E-02	2.30E-05	
	bis(2-chloroethyl)ether	3.56E-07	YES	1.10E+00	3.92E-07	
	chloroform	4.35E-06	YES	6.10E-03	2.65E-08	
	1,1-dichloroethane	4.48E-07	—	—	—	
	1,2-dichloroethane	7.54E-04	YES	9.10E-02	6.86E-05	
	1,1-dichloroethene	2.77E-06	YES	6.00E-01	1.66E-06	
	1,1,2,2-tetrachloroethane	1.07E-08	YES	2.00E-01	2.14E-09	
	tetrachloroethene	9.60E-06	YES	5.10E-02	4.90E-07	
	1,1,2-trichloroethane	1.36E-03	YES	5.70E-02	7.75E-05	
	trichloroethene	2.71E-04	YES	1.10E-02	2.98E-06	
	vinyl chloride	1.61E-06	YES	1.90E+00	3.06E-06	1.78E-04
Inhalation	benzene	8.65E-03	NO	2.90E-02	2.51E-04	
	bis(2-chloroethyl)ether	1.44E-05	NO	1.15E+00	1.66E-05	
	chloroform	7.16E-05	NO	8.50E-02	6.09E-06	
	1,1-dichloroethane	1.12E-05	—	—	—	
	1,2-dichloroethane	1.16E-03	NO	9.10E-02	1.06E-04	
	1,1-dichloroethene	3.16E-05	NO	1.20E+00	3.79E-05	
	1,1,2,2-tetrachloroethane	1.07E-05	NO	2.00E-01	2.14E-06	
	tetrachloroethene	1.95E-03	NO	1.80E-03	3.51E-06	
	1,1,2-trichloroethane	7.93E-03	NO	5.70E-02	4.52E-04	
	trichloroethene	1.59E-03	NO	1.70E-02	2.70E-05	
	vinyl chloride	1.08E-04	NO	2.90E-01	3.13E-05	9.33E-04
TOTAL EXPOSURE RISK FOR RESIDENT CHILDREN						2.36E-03
FUTURE LAND USE						
RESIDENT ADOLESCENTS: Dermal contact with chemicals in sediment						
	bis(2-ethylhexyl)phthalate	4.56E-08	YES	1.40E-02	6.38E-10	
	PCDDs/PCDFs	1.58E-11	YES	1.50E+05	2.37E-06	
	arsenic	1.33E-07	YES	2.25E+00	2.99E-07	
	beryllium	4.45E-08	YES	4.30E+02	1.91E-05	2.18E-05
TOTAL ADDITIONAL EXPOSURE RISK FOR RESIDENT ADOLESCENTS						2.18E-05

NOTE: *RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = AdjRfD

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1994)
0.01 for beryllium (ATSDR, 1992)
0.07 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
CURRENT LAND USE						
ADULT WORKERS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	1.01E-07	NO	1.40E-02	1.41E-09	
	PCDDs/PCDFs	6.99E-12	NO	1.50E+05	1.05E-06	
	arsenic	1.64E-06	NO	1.80E+00	2.95E-06	
	beryllium	4.89E-07	NO	4.30E+00	2.10E-06	6.10E-06
Dermal contact	bis(2-ethylhexyl)phthalate	6.02E-08	YES	1.40E-02	8.43E-10	
	PCDDs/PCDFs	4.16E-12	YES	1.50E+05	6.24E-07	
	arsenic	1.95E-07	YES	2.25E+00	4.39E-07	
	beryllium	5.82E-08	YES	4.30E+02	2.50E-05	2.61E-05
TOTAL EXPOSURE RISK FOR ADULT WORKERS						3.22E-05

NOTE *-R/Ds for dermal exposure pathways are adjusted for absorption as follows:

R/D x ABS = Adj R/D

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

HIGGINS FARM

	Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	SF* (mg/kg-day)-1	Chemical-specific Risk	Total Pathway Risk
CURRENT LAND USE						
ADOLESCENT TRESPASSERS: Ingestion of and dermal contact with chemicals in soil						
Ingestion	bis(2-ethylhexyl)phthalate	2.95E-09	NO	1.40E-02	4.13E-11	
	PCDDs/PCDFs	2.03E-13	NO	1.50E+05	3.05E-08	
	arsenic	4.78E-08	NO	1.80E+00	8.60E-08	
	beryllium	1.42E-08	NO	4.30E+00	6.11E-08	1.78E-07
Dermal contact	bis(2-ethylhexyl)phthalate	1.76E-08	YES	1.40E-02	2.46E-10	
	PCDDs/PCDFs	1.22E-12	YES	1.50E+05	1.83E-07	
	arsenic	5.71E-08	YES	2.25E+00	1.28E-07	
	beryllium	1.70E-08	YES	4.30E+02	7.31E-06	7.62E-06
ADOLESCENT TRESPASSERS: Dermal contact with chemicals in sediment						
	bis(2-ethylhexyl)phthalate	2.28E-08	YES	1.40E-02	3.19E-10	
	PCDDs/PCDFs	7.90E-12	YES	1.50E+05	1.19E-06	
	arsenic	6.64E-08	YES	2.25E+00	1.49E-07	
	beryllium	2.22E-08	YES	4.30E+02	9.55E-06	1.09E-05
TOTAL EXPOSURE RISK FOR ADOLESCENT TRESPASSERS						1.87E-05

NOTE: *-RfDs for dermal exposure pathways are adjusted for absorption as follows:

RfD x ABS = Adj RfD

Where ABS = 1.0 for organic chemicals (default value)
0.1 for arsenic (USEPA, 1984)
0.01 for beryllium (ATSDR, 1988)
0.02 for mercury (ATSDR, 1989)

TABLE 12
ALTERNATIVE 1 COSTS

CAPITAL COSTS	$ 0
OPERATION AND MAINTENANCE (O&M) COSTS	
Labor @ $25/hr	2,000
Ground water monitoring: Analytical (32 samples @ $1,800/sample for TCL/TAL)	57,600
SUBTOTAL	59,600
CONTINGENCY (20%)	11,900
O&M SUBTOTAL	71,500
PRESENT WORTH O&M COSTS (30 YEARS AT 5%)	1,099,100
TOTAL PRESENT WORTH VALUE (Capital and O&M Costs)	$1,099,100

TABLE 13
SENSITIVITY ANALYSIS OF O & M COSTS FOR ALTERNATIVES 1-3

Treatment Time Frame	Present Worth O & M Costs		
	Alternative 1	Alternative 2	Alternative 3
Annual O & M Costs	$ 71,500	$ 262,100	$ 384,000
5 Years	$ 309,500	$ 1,134,600	$ 1,662,300
10 Years	$ 552,100	$ 2,023,900	$ 2,965,200
15 Years	$ 742,200	$ 2,720,600	$ 3,985,900
20 Years	$ 891,000	$ 3,266,300	$ 4,785,400
25 Years	$ 1,007,700	$ 3,694,000	$ 5,412,100
30 Years	$ 1,099,100	$ 4,029,000	$ 5,902,800

Note:
5% discount rate assumed for all present worth calculations.

ALTERNATIVE 2 COSTS	
CAPITAL COSTS	
Ground Water Extraction	$137,000
Extraction System Monitoring Wells (3)	45,000
Treatment System Building	50,000
Equalization	7,000
Aeration	49,000
Chemical Precipitation, Flocculation, Clarification, and Filtration (includes chemical feed systems)	98,000
Intermediate/Final pH Adjustment	16,000
Ion Exchange	72,000
Discharge to Surface Water	50,000
SUBTOTAL	524,000
SITE WORK (20%)	104,800
ELECTRICAL, I&C, AND MECHANICAL (30%)	157,200
SUBTOTAL	786,000
Transporation and disposal of RI and past removal wastes	87,200
SUBTOTAL	873,200
CONTINGENCY (20%)	174,600
SUBTOTAL	1,047,800
ENGINEERING AND ADMINISTRATION (20%)	209,600
OVERHEAD & PROFITS (15%)	157,200
TOTAL CAPITAL COSTS	1,414,600
OPERATION AND MAINTENANCE (O&M) COSTS	
Labor (@ $25/hour)	52,000
System influent/effluent monitoring (24 samples @ $1,800/sample for TCL/TAL)	43,200
Extraction System Monitoring (12 samples @ $1,800/sample for TCL/TAL)	21,600
Power (@ $0.10/k W-hr)	40,000
Chemicals	13,000
Resin disposal and replacement	25,000
Metal hydroxide sludge disposal	23,600
SUBTOTAL	218,400
CONTINGENCY (20%)	43,700
TOTAL ANNUAL O&M	262,100
PRESENT WORTH O&M COSTS (30 YEARS AT 5%)	4,029,000
TOTAL PRESENT WORTH VALUE (Capital and O&M Costs)	$5,443,600

ALTERNATIVE 3 COSTS

CAPITAL COSTS	
Ground Water Extraction	$365,300
Extraction System Monitoring Wells (3)	45,000
Treatment System Building	50,000
Equalization	14,000
Aeration	58,000
Chemical Precipitation, Flocculation, Clarification, and Filtration (includes chemical feed systems)	150,000
Intermediate/Final pH Adjustment	25,000
Ion Exchange	175,000
Discharge to Surface Water	133,000
SUBTOTAL	1,015,300
SITE WORK (20%)	203,100
ELECTRICAL, I&C, AND MECHANICAL (30%)	304,600
SUBTOTAL	1,523,000
Transportation and disposal of RI and past removal wastes	87,200
SUBTOTAL	1,610,200
CONTINGENCY (20%)	322,000
SUBTOTAL	1,932,200
ENGINEERING AND ADMINISTRATION (20%)	386,400
OVERHEAD & PROFITS (15%)	289,800
TOTAL CAPITAL COSTS	2,608,400
OPERATION AND MAINTENANCE (O&M) COSTS	
Labor (@ $25/hour)	52,000
System influent/effluent monitoring (24 samples @ $1,800/sample for TCL/TAL)	43,200
Extraction System Monitoring (12 samples @ $1,800/sample for TCL/TAL)	21,600
Power (@ $0.10/k W-hr)	80,000
Chemicals	26,000
Resin disposal and replacement	50,000
Metal hydroxide sludge disposal	47,200
SUBTOTAL	320,000
CONTINGENCY (20%)	64,000
TOTAL ANNUAL O&M	384,000
PRESENT WORTH O&M COSTS (30 YEARS AT 5%)	5,902,800
TOTAL PRESENT WORTH VALUE (Capital and O&M Costs)	$8,511,200

Table 16
CHEMICAL-SPECIFIC ARARs & TBCs
FOR REMEDIATION OF GROUND WATER

Compound	Maximum Concentration Detected (µg/l)	Frequency of Detection	NJ GWQ Criteria[a] (µg/l). (ARAR)	NJ Proposed Cleanup Standards[b] (µg/l) (TBC)	New Jersey MCL[c] (µg/l) (ARAR)	Federal MCL[d] (µg/l) (ARAR)	Federal MCLG[d] (µg/l) (ARAR/ TBC)[e]	Selected Remedial Requirement (µg/l)
Semivolatile Organics								
Bis(2-chloroethyl) ether	2.0	2/22	—	10	—	—	—	—
Bis(2-ethylhexyl)phthalate	10.0	1/22	—	30	—	6	0	6
2-Chlorophenol	6.0	2/22	—	40	—	—	—	—
1,2-Dichlorobenzene	48.0	3/22	—	600	600	600	600	600
1,3-Dichlorobenzene	5.0	5/22	—	600	600	600	600	600
1,4-Dichlorobenzene	2.0	1/22	—	70	—	75	75	75
Di-n-butylphthalate	0.9	2/22	—	900	—	—	—	—
Diethyl phthalate	1.0	1/22	—	5,000	—	—	—	—
Hexachlorobutadiene	5.3	1/22	—	1	—	—	—	—
Isopropylbenzene	4.6	6/22	—	—	—	—	—	—
Naphthalene	0.38	2/22	—	30	—	—	—	—
N-Butylbenzene	5.0	2/22	—	—	—	—	—	—
N-Propylbenzene	4.5	2/22	—	—	—	—	—	—
P-Isopropyltoluene	5.0	2/22	—	—	—	—	—	—
Phenol	9.0	3/22	3,500	4,000	—	—	—	—
Sec-Butylbenzene	4.9	2/22	—	—	—	—	—	—
Tert-Butylbenzene	4.9	4/22	—	—	—	—	—	—
1,2,3-Trichlorobenzene	1.4	2/22	—	—	8	—	—	8
1,2,4-Trichlorobenzene	1.7	5/22	—	9	8	9	9	8
1,2,4-Trimethylbenzene	3.2	4/22	—	—	—	—	—	—
1,3,5-Trimethylbenzene	3.9	3/22	—	—	—	—	—	—
Inorganic Compounds								
Aluminum	304,000.0	27/42	—	—	—	—	—	—
Antimony	28.5	4/44	—	20	—	6	6	6
Barium	1,890.0	38/42	1,000	2,000	—	2,000	2,000	2,000
Beryllium	25.7	7/44	—	20	—	4	4	4
Cadmium	4.1	3/44	10	4	—	5	5	5
Chromium	403.0	20/44	50	100	—	100	100	100
Cobalt	826.0	25/42	—	—	—	—	—	—
Copper	8,750.0	29/39	1,000[f]	—	—	1,300	1,300	1,300
Iron	433,000.0	41/44	300[f]	—	—	—	—	—

Table 16
CHEMICAL-SPECIFIC ARARs & TBCs
FOR REMEDIATION OF GROUND WATER

Compound	Maximum Concentration Detected (µg/l)	Frequency of Detection	NJ GWQ Criteria[a] (µg/l) (ARAR)	NJ Proposed Cleanup Standards[b] (µg/l) (TBC)	New Jersey MCL[c] (µg/l) (ARAR)	Federal MCL[d] (µg/l) (ARAR)	Federal MCLG[d] (µg/l) (ARAR/ TBC)[e]	Selected Remedial Requirement (µg/l)
Lead	81.4	20/31	50	10	—	15	0	15
Magnesium	27,200.0	44/44	—	—	—	—	—	—
Manganese	24,800.0	42/42	50[f]	—	—	—	—	—
Nickel	224.0	18/43	—	100	—	100	100	100
Vanadium	1,490.0	14/44	—	—	—	—	—	—
Zinc	811.0	32/32	5,000[f]	5,000	—	—	—	—

Notes:

[a]New Jersey Ground Water Quality Standards for Class GW2, NJAC 7:9-6, adopted effective March 4, 1981; readopted June 3, 1988.
[b]New Jersey Proposed Cleanup Standards, NJAC 7:26D-4 for Class IIA Ground Water.
[c]New Jersey Drinking Water Regulations NJAC 7:10.
[d]Environmental Protection Agency Primary Drinking Water Regulations 40 CFR 141. Maximum Contaminant Levels (MCL) and Maximum Contaminant Level Goals (MCLG), April 1992 and May 1992 (Phave V Rule).
[e]MCLGs that are set above zero are ARARs. Zero values are TBCs. (Federal Register, Vol. 55, No. 46, March 8, 1990).
[f]New Jersey Ground Water Quality Secondary Standards, NJAC 7:9-6.

— Value not available.

Source of selected remedial requirement

Table 17
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) (TBC)	NJPDES[b] (µg/l)		FAWQC[c] (µg/l) (AR .R)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
				Aquatic[f] (ARAR)	Potable[g] (ARAR)			
Volatile Organics								
Acetone	5.2	—	—	—	—	—	1.0	ND (1.0)
Benzene	1,200.0	—	—	5,300	—	1.2	1.0	ND (1.0)
Bromobenzene	1.4	—	—	—	—	—	1.0	ND (1.0)
Carbon Disulfide	2.1	5.0	—	—	—	—	1.0	5.0
Carbon Tetrachloride	3.3	1.4	—	35,200	—	0.25	1.0	1.4
Chlorobenzene	1,100.0	—	—	250	488	680.0	1.0	ND (1.0)
Chloroform	33.^	—	—	28,900	—	5.7	1.0	ND (1.0)
2-Chlorotoluene	3.5	—	—	—	—	—	1.0	ND (1.0)
4-Chlorotoluene	2.5	—	—	—	—	—	1.0	ND (1.0)
Cis-1,2-Dichloroethene	76.0	—	—	11,600	—	—	1.0	ND (1.0)
1,1-Dichloroethane	3.0	—	—	—	—	—	1.0	ND (1.0)
1,2-Dichloroethane	320.0	—	—	20,000	—	0.38	1.0	ND (1.0)
1,1-Dichloroethene	10.0	—	—	11,600	—	0.057	1.0	ND (1.0)
1,2-Dichloropropane	0.56	—	—	5,700	—	0.52	1.0	ND (1.0)
1,1-Dichloropropene	4.3	—	—	244	87	—	1.0	ND (1.0)
Ethylbenzene	1.0	—	—	32,000	1,400	3,100.0	1.0	ND (1.0)
Trans-1,2-Dichloroethene	13.0	—	—	11,600	—	700.0	1.0	ND (1.0)
1,1,2,2-Tetrachloroethane	7.5	—	—	2,400	—	0.17	1.0	ND (1.0)
Tetrachloroethene	270.0	—	—	840	—	0.8	1.0	ND (1.0)
Toluene	1.9	1.3	—	17,500	14,300	6,800.0	1.0	1.3
1,1,1,2-Tetrachloroethane	1.4	—	—	9,320	—	—	1.0	ND (1.0)
1,1,1-Trichloroethane	4.2	—	—	18,000	18,400	3,100.0	1.0	ND (1.0)
1,1,2-Trichloroethane	1,100.0	—	—	9,400	—	0.6	1.0	ND (1.0)
Trichloroethene	220.0	—	—	45,000	—	2.7	1.0	ND (1.0)
Trichlorofluoromethane	3.8	—	—	11,000	—	—	1.0	ND (1.0)
Vinyl chloride	86.0	—	—	—	—	2.0	1.0	ND (1.0)
Xylenes (total)	13.8	—	—	—	—	—	1.0	ND (1.0)
Semivolatile Organics								
Bis(2-chloroethyl)ether	2.0	—	—	—	—	0.031	5.0	ND (5.0)
Bis(2-ethylhexyl)phthalate	10.0	—	—	3	—	1.8	5.0	ND (5.0)
2-Chlorophenol	6.0	—	—	4,380	—	—	5.0	ND (5.0)

Table 17
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) (TBC)	NJPDES[b] (µg/l)		FAWQC[c] (µg/l) (ARAR)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
				Aquatic[f] (ARAR)	Potable[g] (ARAR)			
1,2-Dichlorobenzene	48.0	—	—	763	400	2,700.0	10.0	ND (10.0)
1,3-Dichlorobenzene	5.0	—	—	763	400	400.0	10.0	ND (10.0)
1,4-Dichlorobenzene	20.0	—	—	763	400	400.0	10.0	ND (10.0)
Di-n-butylphthalate	0.9	—	—	3	34,000	—	5.0	ND (5.0)
Di-n-octylphthalate	ND	1.0	—	3	—	—	5.0	ND (5.0)
Diethyl phthalate	1.0	42.0	—	3	350,000	23,000.0	5.0	42.0
Hexachlorobutadiene	5.3	—	—	9.3	—	0.44	1.0	ND (1.0)
Isopropylbenzene	4.6	—	—	—	—	—	1.0	ND (1.0)
Naphthalene	0.38	—	—	620	—	—	1.0	ND (1.0)
N-Butylbenzene	5.0	—	—	—	—	—	1.0	ND (1.0)
N-Propylbenzene	4.5	—	—	—	—	—	1.0	ND (1.0)
P-Isopropyltoluene	5.0	—	—	—	—	—	1.0	ND (1.0)
Phenol	9.0	—	—	2,560	3,500	—	5.0	ND (5.0)
Sec-Butylbenzene	4.9	—	—	—	—	—	1.0	ND (1.0)
Tert-Butylbenzene	4.9	—	—	—	—	—	1.0	ND (1.0)
1,2,3-Trichlorobenzene	1.4	—	—	250	—	—	1.0	ND (1.0)
1,2,4-Trichlorobenzene	1.7	—	—	250	—	—	10.0	ND (10.0)
1,2,4-Timethylbenzene	3.2	—	—	—	—	—	1.0	ND (1.0)
1,3,5-Trimethylbenzene	3.9	—	—	—	—	—	1.0	ND (1.0)
Inorganic Compounds								
Aluminum	304,000.0	2,310.0	—	—	—	87.0[h,j]	100.0	2,310.0
Antimony	28.5	—	—	1,600	146	14.0	5.0	ND (5.0)
Barium	1,890.0	27.5	1,000	—	—	—	20.0	27.5
Beryllium	25.7	—	—	5.3	—	0.0077	1.0	ND (1.0)
Cadmium	4.1	—	10	0.012	10	0.25[j]	1.0	ND (1.0)
Chromium	403.0	—	50	0.29	50	11.0	10.0	ND (10.0)
Cobalt	826.0	5.2	—	—	—	—	10.0	ND (10.0)
Copper	8,750.0	6.4	—	5.6	—	2.32[j]	10.0	ND (10.0)
Iron	433,000.0	4,950	—	—	—	300.0[h]	100.0	4,950
Lead	81.4	12.0	50	.75	50	0.28[j]	0.3	12.0
Magnesium	27,200.0	3,780	—	—	—	—	5,000.0	ND (5,000.0)
Manganese	24,800.0	325	—	—	—	50.0[h]	10.0	325

Table 17
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) TBC)	NJPDES[b] (µg/l)		FAWQC[c] (µg/l) (ARAR)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
				Aquatic[f] (ARAR)	Potable[g] (ARAR)			
Nickel	224.0	—	—	56	13.4	31.45[j]	20.0	ND (20.0)
Vanadium	1,490.0	14.4	—	—	—	—	10.0	14.4
Zinc	811.0	292	—	47	—	—	20.0	292

Note:

The following conventional parameter limits must also be considered:

Parameter	Maximum Detected In Ground Water	Maximum Detected In Surface Water	Limit	Rationale
BOD	—	2.1 ppm	25 ppm	NJAC 7:9-5.1.
COD	—	15 ppm	31 ppm	Assume BOD:COD ratio is 0.8.
TDS	—	74 ppm	95 ppm	133% of natural background concentration. NJAC 7:9-4.
pH	8.4	6.9	6.5-8.5	NJAC 7:9-4.
TSS	25,900 ppm	—	40 ppm	NJAC 7:9-4.
Whole effluent toxicity	—	—	L_c = 100	No observed effects using 100% effluent. NJAC 7:9-4.

Treatability testing will determine the ability of a treatment system to meet these limits.

[a]New Jersey Surface Water Quality Standards NJAC 7:9-4 for FW2-NT Waters.
[b]New Jersey Pollutant Discharge Elimination System Regulations NJAC 7:14A, Appendix F, Values for Determination of NJPDES Permit Toxic Effluent Limitations.
[c]Federal Ambient Water Quality Criteria. Quality Criteria for Water. May 1, 1987. EPA 440/5-86-001. From "Toxics Rule".
[d]MDLs are best available Contract Laboratory Program analytical method detection limit. [From Superfund Analytical Methods for Low Concentration Water for Organics Analysis (6/91) and Superfund Analytical Methods for Low Concentration Water for Inorganics Analysis (10/91)].
[e]Anti-degradation goal is based on the maximum concentration detected in surface water. If contaminant was not detected in surface water or if detected below the method detection limit, the MDL is the anti-degradation goal.
[f]Maximum Values for Protection of Aquatic Life.
[g]Maximum Values for Protection of Potable Water Supplies.
[h]Federal Ambient Water Quality Criteria; non-priority pollutants.
[i]pH dependent criterion. Value given based on a pH of 6.5 to 9.0.
[j]Hardness dependent criterion. Value given based on an assumed total hardness of 15 mg/l.

— Value not available.
ND = Not Detected

APPENDIX III

ADMINISTRATIVE RECORD INDEX

Document Number: HFM-001-1643 To 1656 Date: / /

Title: (Tax maps of Franklin Township, Somerset County, NJ and South Brunswick Township, Middlesex County, NJ)

Type: GRAPHIC
Author: Rimmey, William M.: none
Recipient: none: none

Document Number: HFM-001-0001 To 0001 Date: / /

Title: (Note to file: The Administrative Record for the Higgins Farm site, Operable Unit 1, was completed in June 1990, and is available at the EPA Public Records Center, 26 Federal Plaza, New York, NY)

Type: OTHER
Author: none: none
Recipient: none: none

Document Number: HFM-001-1686 To 1686 Parent: HFM-001-1682 Date: 01/08/88

Title: (Letter discussing results of dioxin testing of milk and tissue sampling taken at the Higgins Farm)

Type: CORRESPONDENCE
Author: Nusbaum, Sidney R.: NJ Dept of Agriculture
Recipient: Higgins, Mr. & Mrs. Cliff: none

Document Number: HFM-001-1684 To 1685 Parent: HFM-001-1682 Date: 01/15/88

Title: (Memo discussing the results of Higgins Farm cow sampling performed in August 1987)

Type: CORRESPONDENCE
Author: Kunze, Kathleen: NJ Department of Environmental Protection (NJDEP)
Recipient: various: distribution list

Document Number: HFM-001-0033 To 0235 Date: 12/01/89

Title: Work Plan - Remedial Planning Activities at Higgins Farm, Franklin Township, Somerset, New Jersey

Type: PLAN
Author: none: CH2M Hill
Recipient: none: Malcolm Pirnie, Inc.

Document Number: HFM-001-0002 To 0032 Date: 04/10/92

Title: Action Memorandum: Request for a $2 Million Exemption and Removal Action at the Route 518/Higgins Farm Site, Franklin Township, Somerset County, New Jersey

Type: CORRESPONDENCE
Author: Pane, Mark P.: US EPA
Recipient: Sidamon-Eristoff, C.: US EPA

Document Number: HFM-001-0236 To 0516 Date: 06/01/92

Title: Draft Final Remedial Investigation Report - Higgins Farm, Franklin Township, Somerset, New Jersey - Volume 1 of 2

Type: REPORT
Condition: DRAFT
Author: none: CH2M Hill
none: Malcolm Pirnie, Inc.
Recipient: none: US EPA

Document Number: HFM-001-0517 To 1168 Date: 06/01/92

Title: Draft Final Remedial Investigation Report - Higgins Farm, Franklin Township, Somerset, New Jersey - Volume 2 of 2

Type: REPORT
Condition: DRAFT
Author: none: CH2M Hill
none: Malcolm Pirnie, Inc.
Recipient: none: US EPA

Document Number: HFM-001-1373 To 1378 Date: 06/09/92

Title: (Letter clarifying two issues regarding the Human Health and Environmental Risk Assessment raised during the preparation of the Remedial Investigation Report for the Higgins Farm site)

Type: CORRESPONDENCE
Author: Califano, Richard J.: Malcolm Pirnie, Inc.
Recipient: Harney, Joyce: US EPA

Document Number: HFM-001-1169 To 1372 Date: 07/01/92

Title: Technical Memorandum: Human Health and Environmental Risk Assessment, Higgins Farm Site, Somerset County, New Jersey

Type: PLAN
Author: none: Malcolm Pirnie, Inc.
Recipient: none: US EPA

Document Number: HFM-001-1379 To 1641 Date: 07/01/92

Title: Draft Final Feasibility Study Report, Higgins Farm Site, Somerset County, New Jersey

Type: REPORT
Author: none: Malcolm Pirnie, Inc.
Recipient: none: US EPA

Document Number: HFM-001-1666 To 1676 Parent: HFM-001-1658 Date: 07/01/92

Title: Superfund Proposed Plan, Higgins Farm, Franklin Township, Somerset County, New Jersey

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: HFM-001-1642 To 1642 Date: 07/06/92

Title: (Memo regarding an:) Assessment of Dermal Exposure Pathway for the Higgins Farm site

Type: CORRESPONDENCE
Author: Maddaloni, Mark: US EPA
Recipient: Harney, Joyce: US EPA

Document Number: HFM-001-1658 To 1665 Date: 07/14/92

Title: (Letter forwarding and discussing the enclosed Proposed Plan for the Higgins Farm site and stating that a public meeting will be held on August 3, 1992)

Type: CORRESPONDENCE
Author: Feldstein, Janet: US EPA
Recipient: distribution list: various
Attached: HFM-001-1666

Document Number: HFM-001-1677 To 1680 Date: 07/29/92

Title: (Press Release:) EPA to Hold Public Meeting to Discuss Cleanup for Superfund Site in Franklin Township, New Jersey

Type: CORRESPONDENCE
Author: Cahill, Rich: US EPA
Recipient: none: none

Document Number: HFM-001-1681 To 1681 Date: 08/03/92

Title: Agenda: Public Meeting for the Higgins Farm Superfund Site, Franklin, New York (Please note: document is incorrect, should be New Jersey)

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: HFM-001-1657 To 1657 Date: 08/13/92

Title: (Letter discussing an area at the Higgins Farm site designated in the Remedial Investigation Report as the "NJDEPE" fenced area)

Type: CORRESPONDENCE
Author: Horwitz, Gil: New Jersey Department of Environmental Protection and Energy
Recipient: Harney, Joyce: US EPA

Document Number: HFM-001-1682 To 1683 Date: 08/18/92

Title: (Letter discussing issues raised during the August 3, 1992, public meeting regarding the accuracy of the Administrative Record for the Higgins Farm site)

Type: CORRESPONDENCE
Author: Horwitz, Gil: New Jersey Department of Environmental Protection and Energy
Recipient: Harney, Joyce: US EPA
Attached: HFM-001-1684 HFM-001-1686

ADMINISTRATIVE RECORD ADDENDUM

Title: Public Meeting Minutes, Operable Unit #2, Higgins Farm Site, Franklin Township, New Jersey

Date: August 3, 1992
Type: Report
Author: Ruthanne Ungerleider, C.S.R. (Schulman, Ciccarelli & Wiegmann)
Recipient: US EPA

Title: Technical Evaluation of Draft Final RI and FS Reports for the Higgins Farm Site, Somerset County, New Jersey (Letter to Joyce Harney comments prepared for FMC Corporation, submitted to US EPA during the public comment period)

Date: September 18, 1992
Type: Correspondence and Report
Author: ENSR Consulting and Engineering
Recipient: Harney, Joyce: US EPA

Title: Addendum to the Remedial Investigation and Feasibility Study Reports

Date: September 1992
Type: Report
Author: CH2M Hill
Recipient: US EPA

Title: (Memo to file regarding interpretation of the Dermal exposure to soil-borne contaminants at the Higgins Farm Site)

Date: July 1992
Type: Correspondence
Author: Harney, Joyce US EPA
Recipient: Higgins Farm Site File

Title: (Letter requesting a 45-day extension of the public comment period)

Date: August 18, 1992
Type: Correspondence
Author: Stahl, Suzanne: Hannoch Weisman, Counselors at Law for Princeton Gamma Tech, Inc.
Recipient: Harney, Joyce: US EPA

Title: (Letter granting 30-day extension of the public comment period)

Date: August 7, 1992
Type: Correspondence
Author: Harney, Joyce: US EPA
Recipient: Stahl, Suzanne: Hannoch Weisman

Title: (Letter extending the public comment period to September 18, 1992)

Date: August 1992
Type: Correspondence
Author: Harney, Joyce: US EPA
Recipient: Stahl, Suzanne: Hannoch Weisman

Title: (Notice Letter to two potentially responsible parties)

Type: Correspondence
Author: Basso, Raymond: US EPA
Recipients: Hetzer, Thomas, Vice President: NCH Corporation
Popoff, Frank, President: Dow Chemical Corporation

Title: (Letter in response to Notice Letter)

Date: August 19, 1992
Type: Correspondence
Author: Rooks, Sydney, Senior Attorney: Dow Chemical Company
Recipient: Harney, Joyce: US EPA

Title: (Letter to Dow Chemical Company in response to information request regarding their liability)

Date: September 16, 1992
Type: Correspondence
Author: Harney, Joyce A.: US EPA
Recipient: Rooks, Sydney, Senior Attorney: Dow Chemical Company

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Title: (Letter regarding EPA's Proposed Plan)

Type: Correspondence
Author: Palmquist, Robert: Resident
Recipient: Harney, Joyce: US EPA

Title: (Letter regarding EPA's Proposed Plan)

Type: Correspondence
Author: Wilkes, Kevin: Resident
Recipient: Harney, Joyce: US EPA

Title: (Letter regarding EPA's Proposed Plan)

Type: Correspondence
Author: Lewis, John & June: Residents
Recipient: Harney, Joyce: US EPA

APPENDIX V

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
HIGGINS FARM SUPERFUND SITE
FRANKLIN TOWNSHIP, NEW JERSEY

This community relations responsiveness summary is divided into the following sections:

I. Overview: This section discusses the U.S. Environmental Protection Agency's (EPA's) preferred alternative for remedial action.

II. Background: This section briefly describes community relations activities related to the second operable unit at the Higgins Farm site.

III. Public Meeting Comments and EPA Responses: This section provides a summary of commentors' major issues and concerns, and expressly acknowledges and responds to all significant comments raised at the public meeting.

IV. Response to Written Comments: This section provides a summary of, and responses to, written comments received during the public comment period.

I. OVERVIEW

At the initiation of the public comment period on July 15, 1992, EPA presented its preferred alternative for the second operable unit at the Higgins Farm site located in Franklin Township, New Jersey. The first operable unit involved an interim remedy which provided for the installation of a water line to provide the potentially affected residents with an alternate water supply. The second operable unit addresses remediation of contaminated ground water related to the site.

The selected remedy for the second operable unit includes extraction of contaminated ground water underlying the site, treatment and discharge of the treated ground water to the on-site surface water body. In addition, the selected remedy provides for a ground-water monitoring program to evaluate the effectiveness of the extraction and treatment system.

II. BACKGROUND

The Remedial Investigation and Feasibility Study (RI/FS) and the Proposed Plan for the Higgins Farm Operable Unit Two remedy were released to the public on July 15, 1992. These documents were made available to the public in the administrative record file, located at the information repositories maintained at the EPA Superfund Records Center at EPA's Region II office in New York City, at the Mary Jacobs Memorial Library in Rocky Hill, New Jersey and at the Franklin Public Library in Somerset, New Jersey. The notice of availability for these documents was published in the Home News on July 15, 1992. The public was given the opportunity to comment on the

preferred alternative during the public comment period which began on July 15 and concluded on September 18, 1992. In addition, a public meeting was held on August 3, 1992 at the Franklin Township Municipal Building. At this meeting, representatives from EPA answered questions concerning the site and the remedial alternatives under consideration. Responses to the comments received during the comment period, including the public meeting, are provided in this Responsiveness Summary.

III. PUBLIC MEETING COMMENTS AND EPA RESPONSES

The questions and comments raised during the public meeting can be grouped into the following categories:

A. Status of the Water Line Project

B. EPA's Preferred Alternative (Alternative 3)

C. Issues Regarding Potentially Responsible Parties

D. Community Concerns Regarding Real Estate Values

E. Site History

Each question or comment is followed by EPA's response.

A. Status of the Water Line Project

1. **A resident and a member of the Franklin Township Council asked when EPA expected to receive the contractors' bids for the construction of the water line, and if the request for proposals called for work to be completed in 1992.**

   EPA Response: EPA received bids for the construction of the water line on September 8, 1992, and expects to award the contract shortly. Construction activities are expected to begin in October, and should be completed in late 1992 or early 1993.

2. **A resident asked if the contractors who install the water line will also install the lateral connections to the individual homes, and when this would occur.**

   EPA Response: The lateral connections will likely be installed by two or three different contractors in order to expedite completion of the project. The number of contractors will be determined during construction activities, as it is based on

contractor availability and cost. As installation of the water line progresses, the lateral connections will be installed concurrently.

3. **A resident asked who would be paying for the lateral connections to the water line.**

   EPA Response: EPA will be responsible for the cost of the lateral connections, as well as installation of the water line.

4. **A resident asked if the installation of the water line would also include fire hydrants.**

   EPA Response: Franklin Township will provide fire hydrants and will fund the incremental cost of installing a larger diameter water line, in order to address possible future needs of the community.

5. **A representative from the Franklin Township Health Department expressed concern regarding scheduling problems for residential well sampling. He stated that in the past, EPA's contractors have not kept scheduled appointments for sampling residents' wells. The Health Department would like to work with EPA to avoid this occurring in the future.**

   EPA Response: EPA was not aware of the scheduling problems, but is not disputing that there may have been instances of miscommunication. EPA appreciates the assistance of local officials in coordinating site activities, and will keep the Township informed of sampling events. EPA's On-Scene Coordinator, Mike Ferriola, is EPA's contact for carbon unit maintenance, sampling and the water line installation. Mike can be reached at (908) 422-2265. Mike will discuss this issue with the sampling contractors, and try to ensure that, in the future, scheduled appointments are kept.

B. EPA's Preferred Alternative (Alternative 3)

1. **A member of the Franklin Township Council stated that the preferred alternative, Alternative 3, seemed like the most thorough approach and asked when EPA expected the remedy to be implemented.**

   EPA Response: Once the Record of Decision is signed, EPA will offer the potentially responsible parties (PRPs) an opportunity to implement the design and construction of the ground-water remedy. If no agreement is secured, EPA may issue a unilateral administrative order to compel the PRPs to implement the remedy or procure a contractor to design the ground-water extraction and treatment system. The design will take approximately one year to complete. Once the design is completed, EPA will solicit bids for construction of the

remedy. It is expected that construction will be initiated in 1994.

2. **A resident asked how the ground water would be extracted from the aquifer and what would comprise the treatment system.**

   EPA Response: Ground water will be pumped from extraction wells into piping, which will direct the extracted ground water to the treatment system. The treatment system is expected to include metals precipitation, flocculation, clarification, and filtration, followed by aeration (air stripping), intermediate pH adjustment, ion exchange, and final pH adjustment. The treated ground water will then be discharged to the on-site surface water body located in the eastern portion of the property.

3. **A resident asked if the extraction wells would address shallow ground water as well as the ground water in the bedrock aquifer.**

   EPA Response: During the RI, EPA installed both shallow and deep monitoring wells. Although some contamination was observed in shallow monitoring wells, the most severe contamination was shown in the deeper bedrock aquifer. EPA has not yet designed the ground-water extraction system; however, the extraction wells may serve to capture ground water from the shallow aquifer, as well as the deeper bedrock aquifer. The objective in designing the remedy will be to extract and treat as much contaminated ground water as is technically feasible.

4. **A resident expressed concern that Alternative 3 would tend to draw the ground water away from the source areas toward the edge of the property. The resident stated that the source area extraction system of Alternative 2, combined with the proposed off-site monitoring, would more easily and inexpensively handle the ground-water contamination.**

   EPA Response: EPA identified the two source areas through extensive soil sampling on the site. These source areas may not correspond precisely with the most severe ground-water contamination detected. This is due to the complex nature of the fractured bedrock beneath the site. It is rather difficult to determine the exact nature of ground-water flow through the fractured bedrock, and how pumping at one well location may affect another. Therefore, EPA has conceptually designed a system that will ring the entire site with extraction wells (in addition to the source areas) to attempt to extract as much of the contaminated ground water as possible. The treatment system will be regularly monitored for effectiveness in containing and treating the contaminated ground water.

5. **The mayor of Franklin Township asked if EPA had received any comments that would steer the Agency away from Alternative 3.**

EPA Response: As of the date of the public meeting, all written comments received by EPA support Alternative 3 as the preferred alternative.

C. Issues Regarding Potentially Responsible Parties (PRPs)

1. **A member of the Franklin Township Council asked whether EPA had determined who dumped the waste at Higgins Farm, and whether there was a prosecution case against those parties who are responsible.**

EPA Response: EPA has determined that certain companies used Higgins Disposal Service for the disposal of their waste. From this list of Mr. Higgins' customers, EPA has identified approximately seven PRPs whose waste may have been disposed of at the Higgins Farm site. These PRPs have been offered the opportunity to finance or implement work at this site, including the removal action, the RI/FS and the installation of the water line. Each time such an offer was made, the PRPs declined to finance or perform the work. Therefore, to date, EPA has financed and performed all work at the site. If no agreement is reached with the PRPs for the implementation of future work and/or recovery of costs, EPA may recover its costs through legal actions.

D. Community Concerns Regarding Real Estate Values

1. **A resident stated that living near a Superfund site has a detrimental effect on the value of homes. The resident asked when the homes would no longer be considered part of a Superfund site, and if the installation of the water line would have any effect on this designation.**

EPA Response: With the exception of the homes located on the Higgins Farm property, EPA has not designated any homes as being part of the Higgins Farm Superfund site. The installation of the water line to affected residents represents an interim solution to protect public health, but does not serve to remediate contaminated ground water. The Higgins Farm site will be considered a Superfund site until all the contamination is removed from the aquifer, or until EPA believes that we have removed as much contamination as is technically feasible. Once EPA makes this determination, the site may be deleted from the Superfund National Priorities List.

E. Site History

1. **Mrs. Julie Higgins requested that EPA correct its records regarding the use of the cattle that are bred and raised at the site. EPA's records state**

that the cattle are used for breeding purposes only, and not used for milk or sold for beef. According to Mrs. Higgins, the cattle are bred on the Higgins Farm site and then sold for human consumption. In addition, she stated that the results of tissue and milk samples taken from the cows were not indicative of a problem.

EPA Response: EPA acknowledged Mrs. Higgins concern over the misinformation in the records and agreed to make the appropriate corrections, as noted in this Record of Decision.

2. **A resident stated concern over finding inconsistencies regarding Mr. Higgins' site activities in EPA's Proposed Plan, and the characterization of Mr. Higgins as a "perpetrator" rather than a potentially responsible party.**

EPA Response: EPA clarified the site history as follows: In January 1986, Mr. Higgins initiated cleanup activities, including drum excavation at the site. The excavation was halted by the New Jersey Department of Environmental Protection and Energy (NJDEPE) as the activity was not approved by NJDEPE. On February 24, 1986, the NJDEPE issued a directive to Mr. Higgins instructing him to implement a remedial action plan. On April 7, 1986, Mr Higgins' contractor, O.H. Materials, began excavating the drum site. A total of fifty containers, including drums, were excavated; some of their contents spilled into the excavation pit. Liquids were pumped into a holding tank and visibly contaminated soil was placed into two roll-off containers. O.H. Materials' contract with Mr. Higgins was terminated after several days due to payment disputes. On March 23, 1987, NJDEPE formally requested that EPA assume the lead role in mitigating the site. The request specifically asked that EPA conduct a surface cleanup and subsurface evaluation in the excavation pit area, as well as provide security and fencing around the area. On April 8, 1987, EPA initiated the activities to stabilize the site and to control the release of hazardous substances into the environment.

Statements in the Proposed Plan indicate that Mr. Higgins' original excavation activities were conducted without NJDEPE approval, which is an accurate characterization according to EPA's records.

EPA has not made any statements characterizing Mr. Higgins as a perpetrator in the Proposed Plan, or any other documents pertaining to the Higgins Farm site. However, Mr. Higgins has been notified of his potential liability with respect to the Higgins Farm site in accordance with Section 107 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended.

IV. RESPONSE TO WRITTEN COMMENTS

Written questions and comments received during the public comment period can be grouped into the following categories:

A. Incomplete Vertical Delineation of Ground-Water Contamination

B. Identification of Dense Non-Aqueous Phase Liquids

C. Lack of Quantification of Anisotropic Aquifer Conditions

D. Premature Selection of Remedy

E. Inappropriate Selection of Remedy

F. Role of the Water Line

Each question or comment is followed by EPA's response.

A. Incomplete Vertical Delineation of Ground-Water Contamination

1. **A representative of one of the PRPs commented that the vertical delineation of ground-water contamination is incomplete due to the extensive vertical portion of the aquifer that each bedrock well is monitoring. As a result contaminant concentrations at various depths cannot be distinguished.**

   EPA Response: EPA disagrees. The bedrock monitoring well construction requirements were developed based upon review of the characteristics of the site's geology as determined by preliminary field investigations and review of the regional geologic literature. The Trap Rock Industries quarry, located adjacent to the site, exhibits the same geologic units as beneath the site, and was investigated prior to installation of the monitoring wells. Bedrock in this area is highly fractured and faulted; the major fault is moderately to steeply dipping and extends through the entire rock section. Regional ground-water flow is dictated by the near-vertical orientation of the faults and fractures. Since ground-water flow in this setting is dictated by interconnected fractures and faults, EPA used the most cost-effective and efficient method of establishing the hydrogeologic characteristics of the deep bedrock; construction of single open borehole monitoring wells extending approximately 180 feet were examined for fracture orientation and permeability by coring and the use of packer tests.

   Furthermore, EPA did investigate the differences in contamination with depth. Monitoring wells were constructed to evaluate ground-water conditions in both

the shallow unconsolidated and deep bedrock zones underlying the site. The purpose of placing wells discretely in each zone was to determine whether contaminants were migrating from the shallow unconsolidated zone to the deep bedrock zone. The shallow unconsolidated zone wells were constructed with either five- or ten- foot length well screens. The deep bedrock zone monitoring wells were constructed in a manner which sealed them off from the shallow unconsolidated zone, (i.e., a six-inch diameter steel casing was installed from the surface into the bedrock).

Contaminants were detected above federal and state ground-water quality standards in both the shallow unconsolidated and deep bedrock zones, demonstrating that contaminants flowed from the shallow to the deep zone. Since ground-water flow, and consequently contaminant flow, is dictated by the fractures and faults in the deep bedrock zone, it was not crucial to this investigation to determine the differences in contaminant concentrations at various depths within the deep bedrock zone. Rather, the goal was to determine the nature and extent of contamination in the ground water and to gather information regarding the occurrence of fractures and faults underlying the site. Furthermore, the delineation of the vertical extent of ground-water contamination as suggested by the commenter (i.e., the installation of more monitoring wells at discrete vertical intervals) would have been far more costly and time consuming. Therefore, as stated above, the most cost-effective and efficient methodology was used to obtain this information

2. **A representative of one of the PRPs commented that the monitoring well construction employed at the Higgins Farm site violates both EPA guidance (Resource Conservation and Recovery Act (RCRA) Ground-Water Monitoring Technical Enforcement Guidance Document) and NJDEPE (Field Sampling Procedures Manual, May 1992) protocols for bedrock monitoring well construction.**

EPA Response: EPA disagrees. Bedrock monitoring well construction was consistent with EPA and NJDEPE guidance and protocols in effect at the time the monitoring wells were constructed. As discussed above in response to Comment A.1., the bedrock monitoring well construction was specifically tailored to the known subsurface conditions at the site. EPA and NJDEPE determined that the 180-foot open hole length was required to ascertain the exact nature of the fracture system underlying the site. The open hole length was deemed necessary to ensure sufficient intake of formation water.

As specified in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (OSWER-9950.1/September 1986), geologic formations "...with low hydraulic conductivities can also necessitate the use of longer well screens to allow sufficient amounts of formation water to enter the well for

sampling." As specified in EPA's Handbook Ground Water Volume II: Methodology (EPA/625/6-90/016b), the monitoring interval "...and the depth at which it is placed depend, to a large degree, on the behavior of the contaminant as it moves through the unsaturated and saturated zones, and on the goal of the monitoring program."

The goals of the ground-water monitoring program at this Superfund site are not the same as the goals of the generic detection ground-water monitoring programs described in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document. RCRA detection ground-water monitoring programs are specifically geared to hazardous waste management units at hazardous waste facilities; a RCRA detection monitoring system must be capable of immediately detecting a leak from a hazardous waste management unit. The Higgins Farm site is not a hazardous waste facility with hazardous waste management units, but rather, a cattle farm which was suspected to have been used for the disposal of hazardous substances. The goal of EPA's ground-water monitoring program, in this case, was to determine where hazardous substances may have been disposed and determine potential pathways for migration. Therefore, the bedrock monitoring wells were installed within the bounds of EPA guidance relevant to this particular situation.

In addition, the bedrock wells were installed at the Higgins Farm site in October 1990. The NJDEPE Sampling Procedure Manual cited by the commentor was published in May 1992. Consequently, EPA could not utilize NJDEPE's protocols, which limit the length of open boreholes to 25 feet, nearly two years before it was published. However, EPA did seek NJDEPE recommendations for the RI/FS program at this site. The bedrock monitoring well construction details were specified in the RI/FS Work Plan, which was reviewed by NJDEPE. NJDEPE concurred with the Work Plan's specifications.

B. Identification of Dense Non-Aqueous Phase Liquids (DNAPLs)

1. A representative of one of the PRPs commented that EPA did not evaluate the potential for the presence of DNAPLs at the site, and that based on following site data, it is quite reasonable to suspect that DNAPLs are present at the site: 1) two of the residential wells sampled had concentrations greater than 1 part per million (ppm) of chlorinated volatile compounds; 2) several chlorinated compounds were detected in ground-water samples at 0.1% to 1.0% of their solubility limits; 3) the site was used for liquid waste disposal; and 4) numerous contamination anomalies exist across the site.

EPA Response: EPA disagrees. The presence of DNAPLs was considered during remedial investigation activities at the site. The investigation included

visual observation, soil borings and sampling, ground water monitoring well installation and sampling, and excavation of numerous test pits across the site. At no time during these field investigations did EPA find evidence of the presence of DNAPLs.

However, according to EPA publication 9355.4-07FS, entitled **Estimating Potential for Occurrence of DNAPL at Superfund Sites**, January 1992, visual observations should not be considered the sole indicator of the presence of DNAPLs. According to this guidance, other conditions that indicate the potential for DNAPL at a site include the presence of DNAPL-related chemicals in ground water at levels greater than 1% of their effective solubility. As noted by the commentor, several chlorinated compounds were detected in ground-water samples at levels of 0.1% to 1.0% of their solubility limits, but not at levels greater than 1%. Therefore, the analytical data also does **not** indicate that DNAPL is present at the site.

The technical merit of the commentor's reference to the 1 ppm level is unclear. It is acknowledged that recent sample analysis of the two residential well samples did indicate the presence of trichloroethane at 1.1 ppm and chlorobenzene at 1.2 ppm.

With respect to disposal of liquid wastes at the site, although there is evidence of disposal of a wide variety of wastes at Higgins Farm, EPA does not believe that this necessarily leads to the conclusion that DNAPLS are present. Rather, when all site data and related information are analyzed together, the evidence suggests that DNAPLs are not present.

Furthermore, the "anomalies" in the levels of ground-water contamination across the site are a result of the presence of fractured bedrock. Fracture flow is not dictated by the usual "upgradient to downgradient" flow regime of an unconsolidated aquifer. Ground-water flow in a fractured bedrock system is non-uniform, making it difficult to ascertain the pattern of local ground-water flow. Consequently, EPA believes that it is the alignment of fractures in the bedrock and the corresponding preferential ground-water flow in a given area which accounts for these variations in contaminant levels, rather than DNAPLs.

C. Lack of Quantification of Anisotropic Aquifer Conditions

1. A representative of one of the PRPs commented that, as stated in the Feasibility Study, the data obtained during the pumping test does not conclusively verify that the aquifer is anisotropic and heterogeneous. In addition, the commentor stated that quantification of anisotropic conditions, which is necessary to evaluate the feasibility of a pump-and-treat remedy, was not conducted.

EPA Response: EPA agrees with the commentor that the data obtained during the pumping test does not **conclusively** verify that the aquifer is anisotropic and heterogeneous.

However, the primary purpose of the pumping test at the Higgins Farm site was to provide information on the yield and drawdown of a potential extraction well to be used in a remediation system. This type of information was needed to determine if a pump-and-treat remedy was feasible at this site, as well as to estimate an approximate cost based on well yield. In addition, the pumping test data was used to calculate aquifer properties, based on distance/drawdown/ time data from the pumping well and the observation wells. Furthermore, since flow beneath the site is controlled by faults and fractures, it was important to ascertain whether the fractures at one location were connected to fractures at other locations. This pump test served all of the these goals satisfactorily.

One of the most important properties of an aquifer, and the ground water flowing within it, is hydraulic conductivity. Hydraulic conductivity is the capacity of a porous medium to transmit water. When hydraulic conductivity values show spatial variations within a geologic formation, the geologic formation is considered to be heterogeneous. When the hydraulic conductivity values show variations with the direction of measurement at any point in the formation, the formation is considered to be anisotropic. Although for some purposes, it may be important to quantify the exact degree to which the geologic formations underlying are heterogeneous and anisotropic (or homogeneous and isotropic), EPA disagrees with the commentor that it is necessary for evaluating the feasibility of a pump-and-treat remedy at this site. The pumping test that was conducted at the site demonstrated that a sufficient well yield was obtained to create a cone-of-depression which would capture contaminated ground water.

Finally, visual evidence of the aquifer's heterogeneity and anisotropy exists. The geologic formations underlying the Higgins Farm site are exposed in the adjacent quarry.

D. Premature Selection of Remedy

1. A representative of one of the PRPs commented that the elimination of the containment technologies evaluated in the Feasibility Study was not based on sound technical premises and should be reconsidered as a possible remedy.

EPA Response: EPA disagrees. The initial screening of technologies is based on technical implementability and effectiveness considering site-specific conditions, contaminant types and concentrations. As a result of this initial screening, those technologies that are either not implementable or would not be

effective due to site or waste characteristics are eliminated from further study.

Physical containment options evaluated during the initial screening of technologies included both vertical and horizontal barriers. Due to the geologic characteristics of the site, such containment options were screened out for the following reasons: there is no well-defined confining layer, which is necessary to support vertical or horizontal barriers; subsurface conditions at the site consist of fractured bedrock, and vertical barriers are generally applied in unconsolidated subsurface environments where soils can be excavated or sheet piles driven; and the most significant ground-water contamination occurs in the deeper bedrock at the site, at depths largely beyond the practical limits for slurry walls and grout curtains. EPA believes that containment will be achieved, to the extent practicable, through hydraulic control as part of the selected remedy.

2. **A representative of one of the PRPs commented that the lack of understanding of the anisotropic conditions should have initiated a pilot-scale treatability study, close to the source areas to simulate physical and chemical parameters of the proposed full-scale system, before selection of a remedy to determine if pump-and-treat technology is feasible for the site. The commentor recommended that this "pumping" treatability study be utilized as an interim measure to address the source areas while further delineating ground-water contamination at the site.**

EPA Response: EPA disagrees. As stated in response to comment C.1. above, the pumping tests conducted at the site were sufficient to provide information regarding the feasibility of pumping and the yield that could be expected, as well as to investigate the presence of aquifer anisotropy and heterogeneity. Based on these tests, EPA is confident that pump-and-treat technology is feasible for the Higgins Farm site. The design of the actual treatment system will include studies of aquifer characteristics to optimize the number and placement of extraction wells.

3. **A representative of one of the PRPs commented that, because of data gaps, including lack of a pilot scale pump and treat study, the need to reconsider containment technologies, the potential for DNAPLs, failure to properly delineate the vertical extent of contamination, and the failure to quantify anisotropy, EPA should not yet select a remedy for the site.**

EPA Response: EPA disagrees. As stated above in response to comments D.2., D.1., B.1., A.1., C.1., EPA does not believe there are any significant data gaps which warrant delaying a remedial decision. The RI showed that there are numerous ground-water contaminants present above federal and state ground-water quality standards, and that area residents depend on ground water for a

potable source of drinking water. Sufficient information has been obtained relative to both the nature of the contamination as well as how to address that contamination to move forward. Consequently, EPA has determined that active measures are necessary to control the migration of contaminants and remediate the ground water. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) provides that:

> "Remedial actions are to be implemented as soon as site data and information make it possible to do so." 40 CFR §300.430(a)(1).

Furthermore, EPA's Guidance entitled **"Considerations in Ground Water Remediation at Superfund Sites"**, OSWER Directive No. 9355.4-03, October 18, 1989, specifically provides recommendations to deal with the uncertainties associated with ground-water remediation. Among these recommendations, which are being applied to the Higgins Farm remedy selection, are 1) initiate response action early, 2) provide flexibility in the selected remedy to modify the system during operation, and 3) acknowledge the possibility that it may not be possible to completely restore the aquifer.

Although EPA acknowledges that there will be some uncertainty regarding the aquifer's response to remedy implementation (as noted in the Record of Decision), it is inappropriate to delay the implementation of the selected remedy.

4. **A representative of one of the PRPs commented that the 180-foot open boreholes in the deep bedrock monitoring wells will continue to act as conduits for the downward migration of ground-water contamination from the shallow aquifer to the bedrock aquifer.**

EPA Response: The near-vertical fractures in the bedrock are natural conduits for ground water to travel from the shallow overburden zone to the deep bedrock zone of the aquifer. Ground-water sample analysis showed that ground-water contamination is greater in the deep monitoring wells. As stated in response to comment A.1., this indicates that ground water, and consequently contamination, is migrating through the fractures via natural means to the deep bedrock zone. Thus, the presence of the 180-foot open boreholes will not necessarily exacerbate the ground-water contamination in the deep bedrock aquifer. Furthermore, it should be noted that there are a significant number of private residential wells in the vicinity of the site, which are of similar construction (open hole).

The proposed extraction system will utilize deep bedrock zone wells to extract contaminated ground water. Contamination will be extracted and treated from both the shallow overburden and deep bedrock zones as the two zones are

interconnected.

Any monitoring wells which will not be used in the proposed extraction or monitoring system will be sealed in accordance with NJDEPE regulations.

E. Inappropriate Selection of Remedy

1. **A representative of one of the PRPs commented that the selected pump-and-treat system associated with Alternative 3 will draw contamination from highly contaminated areas to less or uncontaminated areas, thus spreading contamination over a larger area. The commentor stated that Alternative 2, which involves pumping water from areas closer to the known source areas, would minimize the danger of spreading contamination, thus providing increased protection of human health and the environment.**

EPA Response: During operation of the proposed extraction and treatment system, it is likely that some less contaminated, or uncontaminated ground water will be extracted along with the contaminated ground water. The system will be designed as efficiently as possible with the goal of maximizing the amount of contaminated ground water extracted while minimizing the extraction of clean water. The proposed remedy focuses on the known source areas, as well as around the perimeter of the site where some of the highest levels of contamination have been detected. Pumping ground water from around the source areas only and ignoring highly contaminated ground water at the perimeter of the site would not be as protective since this approach would allow ground-water contaminants to continue to migrate from the site.

It is also important to note that all ground water which is extracted (regardless of degree of contamination) will be treated to acceptable levels and discharged to the surface water body located at the site.

2. **A representative of one of the PRPs commented that although Alternative 3 was selected, in part, for its ability to capture contamination from possible unknown sources at the site, upgradient sources cannot be ruled out due to incomplete definition of upgradient ground-water quality conditions.**

EPA Response: As stated in response to comment A.1., ground-water flow at the site is dictated by a system of fractures and faults. Due to the complex geologic conditions, it is difficult to ascertain the pattern of local ground-water flow (although there is a general pattern of regional flow from northeast to south-southwest). Therefore, EPA believes that characterizing the local flow pattern to an upgradient vs. downgradient direction may be an over-

simplification and inappropriate in this situation. EPA has no evidence to suggest that there are other sources of ground-water contamination which impact the site.

EPA selected Alternative 3 in order to take the most aggressive approach to ground-water remediation and attempt to restore the aquifer to its beneficial uses.

3. **A representative of one of the PRPs commented that the selection of the thirty-year life expectancy for Alternative 3 is arbitrary as the actual time required for the proposed ground-water cleanup is not known. In addition, the commentor stated that calculations should have been conducted to estimate the life expectancy of the proposed treatment system.**

EPA Response: EPA disagrees. EPA used a present worth cost analysis to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year. This allows the cost of remedial actions to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. As stated in the **Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA** (OSWER Directive 9355.3-01, October 1988):

> "...In general, the period of performance for costing purposes should not exceed thirty years for the purpose of the detailed analysis".

In addition, the present value of operating costs beyond thirty years is considered minimal due to the extended length of time from the present base year used to discount future costs.

As stated in the FS and the Proposed Plan, there is some uncertainty associated with the length of treatment system operation due to the complex nature of ground-water flow through the fractured bedrock. Therefore, the cost estimate of the proposed remedy is based on an estimated time period of five to thirty years. The proposed ground-water remediation system would be monitored regularly for effectiveness, and if it is determined that the proposed remedy is not effective in extracting or treating contaminated ground water at the site, contingency measures may be taken, and the remedy may be reevaluated.

The uncertainty associated with remediation time frames has been discussed in the Record of Decision, consistent with EPA's ground- water guidance, noted in

comment D.3., above.

F. Role of the Water Line

1. A representative of one of the PRPs commented that EPA's analysis of site conditions and remedial alternatives should factor in the role of the provision of alternate water supply (water line) to potentially affected area residents.

EPA Response: EPA did consider the provision of an alternate water supply (water line) to residents affected or potentially affected by the Higgins Farm site in its analysis of site conditions and the evaluation of ground-water remedial alternatives.

The provision of an alternate water supply is considered an interim solution for ground-water contamination, as it does not address the greater problem of restoring water to its beneficial uses. As stated in the Proposed Plan (July 1992), many area residents in the vicinity of the site depend on ground water as a potable water source. Although the water line provided some area residents with an alternate water supply, there remains the potential for contaminated ground water to continue to migrate off site to other residential wells. As determined in the risk assessment, exposure to the contaminated ground water could pose a threat to residents who utilize ground water as their potable water supply. Therefore, additional remedial measures are necessary to restrict the off-site migration of contaminants.

Section 121 of CERCLA, as amended, requires that each selected site remedy be protective of human health and the environment, be cost effective and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. The statute also includes a preference for the use of treatment to reduce toxicity, mobility, or volume of the hazardous substance:

> "Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment."
>
> CERCLA §121(b)(1)

Ground water at the site is classified by NJDEPE as IIA (potential or current drinking water source), and as levels of contamination are above federal and state drinking water standards, this remedial action, is necessary to treat contaminated ground water to restore it to its beneficial use, as well as restrict the off-site migration of contamination. As noted in the NCP:

> "EPA expects to return usable ground waters to their beneficial uses

wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site.....

40 CFR §300.430(a)(1)(iii)(F)

Attachment 2

EXPLANATION OF SIGNIFICANT DIFFERENCES

HIGGINS DISPOSAL

Site Name and Location
Higgins Disposal
Town of Kingston, Franklin Township
Somerset County, New Jersey

INTRODUCTION

The United States Environmental Protection Agency (EPA) presents this Explanation of Significant Differences (ESD) to explain the modification made to the remedy selected in the September 30, 1997 Record of Decision (ROD) for the Higgins Disposal Superfund Site. This modification relates to that portion of the remedy which addresses the treatment of contaminated groundwater and is the result of new information obtained and developed subsequent to the 1997 ROD.

The remedy selected in the 1997 ROD called for contaminated groundwater to be extracted and conveyed via a pipeline to the existing treatment system at the nearby Higgins Farm Superfund Site for remediation to federal and state maximum contaminant levels (MCLs) and the promulgated New Jersey Groundwater Quality Standards Criteria (NJGQSC), the discharge of treated groundwater to surface water, and the implementation of a groundwater monitoring program. In addition, the ROD also required that the ten residences on Laurel Avenue and the Higgins family residence on the site be connected to a potable water supply line. Finally, the ROD stated that five-year reviews will be periodically performed to ensure that the remedy is protective of human health and the environment.

This remedy was based on information presented in the final August 1996 Remedial Investigation and Feasibility Study (RI/FS). However, following the completion of the on-site landfill removal activities and the extension of a potable water supply line to the ten residences of Laurel Avenue and the Higgins residence, EPA and one of the potentially responsible parties (PRPs) agreed to an additional investigation of the site prior to the start of design activities for the groundwater remedy. The purpose of this pre-design investigation (PDI) was to assess the impact of the removal activities on the site groundwater, verify the assumptions made in the RI/FS, and provide a better understanding of the groundwater conditions at the site. In February 2001, the

PRP submitted the PDI report to EPA which generated new information about the site that was not available during the preparation of the ROD. This new information has resulted in a decision to modify the groundwater remedy selected in the 1997 ROD.

EPA is issuing this ESD pursuant to Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended 42 U.S.C. §9617(c), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 C.F.R. §300.435(c)(2)(i). The ESD and documents which form the basis for the decision to change the response action will be incorporated into the Administrative Record file for the site in accordance with Section 300.825(a)(2) of the NCP. The entire Administrative Record for the site is available for public review at the following locations:

Mary Jacobs Memorial Library
64 Washington Street
Rocky Hill, NJ 08553
(609) 924-7073

Hours: 9:30 a.m. - 8:30 p.m. (Monday thru Thursday)
9:30 a.m. - 5:30 p.m. (Friday)
9:30 a.m. - 12:30 p.m. (Saturday)

Franklin Township Public Library
485 De Mott Lane
Somerset, NJ 08873
(732) 873-8700

Hours: 10:00 a.m. - 9:00 p.m. (Monday - Thrusday)
10:00 a.m. - 5:00 p.m. (Friday and Saturday)
1:00 p.m. - 4:00 p.m. (Sunday)

and

U.S. Environmental Protection Agency
290 Broadway - 18th floor
New York, NY 10007
(212) 637-4308

Hours: 9:00 a.m - 4:30 p.m. (Monday - Friday)

This change to the selected remedy is not considered by EPA or the New Jersey Department of Environmental Protection (NJDEP) to be a fundamental modification of the remedy selected in the ROD. The remedy modification will maintain the protectiveness of the

groundwater action with respect to human health and the environment, and complies with federal and state requirements that were identified in the ROD.

SITE BACKGROUND

Location and General Description

The site, which consists of 37.6-acres, is located in a rural area on Laurel Avenue (Kingston-Rocky Hill Road) in Franklin Township, Somerset County, New Jersey. It is bounded by residential properties to the south, a commercial property (Trap Rock Industries' Quarry) to the north, and undeveloped farmland to the east-southeast. The Higgins Farm Superfund Site is located about 1.5 miles to the northeast. Within a three-mile radius of the site, approximately 10,000 people rely on groundwater as a source of drinking water.

A freshwater wetland is located 300 feet from the site as well as two on-site ponds that discharge into Dirty Brook, a tributary of the Delaware/Raritan Canal. Dirty Brook, located along the northern and southern property boundaries, is not used for irrigation or drinking water. The Delaware/Raritan Canal, located approximately three miles downstream from the site, is used for fishing, boating, and swimming. Both the Millstone River and Delaware/Raritan Canal, located approximately 1,500 feet west-southwest of the site, flow north and eventually discharge into the Raritan Bay.

Site History

From the 1950's through 1985, the Higgins Disposal Services, Inc. (HDS) operated a residential, commercial, industrial and construction waste disposal facility that included a waste transfer station and compactor, an underground storage tank, an area for container storage, and a non-permitted landfill on the eastern side of the property. The owner's family currently maintains a residence on the site, as well as an equestrian school (Hasty Acres Riding Club) and a truck repair shop.

In early 1982, NJDEP discovered that HDS was operating an unregistered waste transfer station and an active, non-permitted, landfill on the property. Following an inspection of the property in September 1982, NJDEP issued an Administrative Order to HDS in October 1982. The Order required HDS to cease all operations of the landfill and remove the solid waste from the property.

In August 1985, the owner of several residences on Laurel Avenue (Trap Rock Industries) contacted the Franklin Township Health Department (FTHD) and NJDEP because of medicinal tasting tap water. Subsequently, FTHD and NJDEP sampling of the residential wells on Laurel Avenue revealed the presence of various volatile organic compounds (VOCs). In December 1985, NJDEP began an investigation to determine the source of the contamination. Based on this investigation, NJDEP identified HDS as one of the potential source areas. All residences on Laurel Avenue who did not have access to the public water supply line were notified by NJDEP or FTHD to use bottled water and/or install a whole-house point source filter system.

In September 1986, NJDEP instituted an Interim Well Restriction Area (i.e., the State restricted the installation of new wells for potable use) for the Laurel Avenue area while negotiations continued between Franklin Township and a water supply company to extend a waterline to the residences of Laurel Avenue. These negotiations continued unsuccessfully until approximately 1993.

The site was proposed for inclusion on the National Priorities List (NPL) of Superfund Sites on June 24, 1988. It was added to the NPL on August 30, 1990. Subsequently, EPA conducted a Removal Assessment at the site. This assessment was necessary to determine if any emergency response actions were warranted prior to beginning an investigation of the site.

Summary of Removal Actions

In October 1990, as part of the Removal Assessment, EPA's Environmental Response Team (ERT) collected shallow soil and pond sediment samples from selected areas across the site which were accessible to customers of the Hasty Acres Riding Club. The results of this sampling indicated that polychlorinated biphenyls (PCBs) in the range of 1.2 to 47 parts per million (ppm) were present in the surface soils of the Beginners' Riding Ring. This contamination is believed to be the result of the movement of PCB-contaminated soil from the indoor riding ring after a fire inside the indoor riding ring had caused a lighting ballast containing PCBs to fall on the ground.

From October through November 1992, EPA undertook a removal action which restricted access to the Beginners' Riding Ring during the excavation and disposal of 765 tons of PCB-contaminated soil. The contaminated soil was shipped to a Toxic Substances Control Act permitted landfill in Grandview, Idaho. No other accessible surface locations on the property were found to pose an immediate health concern.

During the course of the RI field work in March 1993, an additional removal action was initiated upon the discovery of buried waste in a field on the property, south of the landfill. Initially, only drums were discovered in this area based on a geophysical survey conducted as part of the RI field activities. However, test trenching activities uncovered laboratory glassware and plastic containers. These test trenches confirmed the presence of hazardous substances in containers and soil at several locations on the site which were primarily near the surface and in areas of an active portion of the Hasty Acres Riding Club. Because this contamination posed a significant threat of potential exposure to the riders and horses, the Agency for Toxic Substances and Disease Registry (ATSDR) recommended the immediate placement of warning signs and to restrict access in this area. As part of a second removal action, a security fence was erected on May 27, 1993.

Following the installation of warning signs and a fence, another geophysical survey was conducted using different instrumentation to search for non-metallic buried waste as well as other buried waste not discovered during the first metallic survey. This survey was completed in the summer of 1993. After an analysis of the results, EPA began excavating areas of known and suspected buried waste in April 1994. Some areas were found to be clean, while others contained a great deal of buried waste, corroded and leaking containers as well as glass bottles and vials, some empty and some containing material.

From April through October 1994, approximately 3,200 containers and 850 tons of contaminated soil (other than the soil from the Beginners' Riding Ring) were excavated and transported off-site for disposal at permitted disposal facilities. In addition, to ensure that the geophysical surveys had identified all areas used for burying waste, additional test trenching was initiated in November 1994. Nine test trenches were excavated to a depth of approximately eight feet below grade. No waste materials were discovered in any of these test trenches.

However, during the excavation of one additional test trench along the vegetated fence line on the eastern side of the site, more buried waste (a 55-gallon drum, two 5-gallon plastic lab jugs, a 40- milliliter (ml) vial, and a bag of resinous white material) was uncovered. This buried waste was consistent with the type of waste found in other burial areas on the site. As a result of this newly-discovered waste material, additional test trenches were excavated to delineate the extent of the buried waste. From November 1994 to May 1996, additional buried waste was excavated as part of EPA's removal activities. By June 1996,

a total of approximately 7,000 containers and 12,000 tons of contaminated soil were excavated and transported off-site for disposal at permitted disposal facilities.

Post-excavation sampling in the summer of 1996 revealed the presence of waste containers near the previously defined edge of the landfill. From September to November 1996, EPA excavated and disposed of approximately 50 laboratory containers and 908 tons of contaminated soils from the southern face of the landfill.

As a result of the excavation of laboratory containers and contaminated soils from the southern face of the landfill, a comprehensive investigation of the landfill area was initiated in the fall of 1996. As part of this investigation, twelve shallow test trenches were excavated near the perimeter of the landfill in January 1997. The results of the excavation indicated that the landfill contained buried containers, drums, and other waste materials.

On March 11, 1998, EPA and the Potentially Responsible Party (PRP) entered into an Administrative Order on Consent (AOC) for the removal of the landfill area at the site. Between August 1998 and June 1999, approximately 34,000 tons of soil, debris and non-native materials and 16,000 containers were excavated and shipped off-site to a permitted disposal facility. After completing the removal activities in June 1999, a small volume of radioactive and mixed wastes remained on-site in a secure area while off-site disposal arrangements were being finalized. The radioactive and mixed waste were removed for off-site disposal in December 1999 and June 2000, respectively.

Summary of Remedial Actions

EPA initiated a Remedial Investigation (RI) in October 1992. The purpose of the RI was to determine the nature and extent of the contamination in the surface and subsurface soils, sediments, surface water and groundwater at the site. The RI results indicated that the majority of the contaminant concentrations and frequency of detection were found to be relatively low throughout the site. However, the highest concentration of VOCs were observed in the groundwater near the landfill. Subsequent to the completion of the RI, the landfill was found to contain significant amounts of hazardous substances mixed with solid waste.

As part of the RI, a baseline risk assessment was conducted to estimate the risks associated with the current and future site conditions. Based on the results of the RI, the risk assessment

concluded that the exposure to contaminated groundwater posed a potential threat to residents who currently utilize groundwater as their potable water supply or residents who will utilize groundwater in the future. The exposure to soils, surface water, and sediments did not pose a significant risk. Following the completion of the RI, an FS was prepared which identified various alternatives for addressing the groundwater contamination at the site. A final RI/FS report was issued in August 1996.

Based on the results from the final RI/FS report, a ROD was signed on September 30, 1997 which selected a groundwater remedy for the site. The major components of the selected remedy included the waterline extension and connection to the residences of Laurel Avenue and the Higgins' residence, the installation of on-site extraction wells, the construction of a pipeline to convey contaminated groundwater to the Higgins Farm Site for treatment and discharge to a surface water body, and the implementation of a monitoring program to ensure groundwater would achieve the federal and state MCLs and the promulgated NJGQSC.

On May 19, 1998, EPA issued a Unilateral Administrative Order (UAO) to the PRP for the extension and connection of a water supply line to the ten residential properties on Laurel Avenue and the Higgins' residence on the site. However, after the UAO had been issued, two additional service connections were included in this remedial action, one for a newly-constructed home on Laurel Avenue, and one for a single resident property that required two separate water meters. The waterline extension and connection to the thirteen residences was completed in April 1999, and a final Laurel Avenue Waterline Extension Remedial Action Report was approved by EPA on September 16, 1999.

From October 1999 to September 2000, an approved pre-design investigation (PDI) to further delineate the extent of groundwater contamination, was conducted by the PRP. A final PDI Report was submitted in February 2001. Subsequently, the PRP prepared and submitted a focused Feasibility Study (FFS), dated June 2001, which re-evaluated several response actions for addressing the site groundwater contamination.

DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE BASIS FOR THOSE DIFFERENCES

The difference between the remedy selected in the September 1997 ROD and the actions described in this ESD relate to the treatment and disposal of contaminated groundwater. The other components

of the selected remedy will remain the same.

The primary remedial objectives for the remedy selected in the September 1997 ROD were to capture and treat the groundwater contamination found at the site, and limit the future off-site migration of the contaminated groundwater.

Based on the FS, EPA selected Alternative 3B as the preferred remedial alternative for the groundwater remedy at the site. Alternative 3B includes the installation of on-site extraction wells, the construction of a pipeline for conveying extracted groundwater to the Higgins Farm waste water treatment plant (WWTP) for treatment, the discharge of treated groundwater to surface water, and the implementation of a monitoring program to ensure the effectiveness of the remedy.

As a result of the new information generated by the PDI, an FFS was prepared which re-evaluated two of the alternatives originally discussed in the FS. Alternative 3B (the ROD selected remedy) and Alternative 4B both meet the remedial objectives outlined for the site. Alternative 4B includes the installation of on-site extraction and reinjection wells, and the construction of a 10 gallons per minute (gpm) treatment plant. On-site reinjection of treated water had been rejected during the FS process. However, new data obtained from the PDI indicated that the overburden soils within the site were sufficiently deep (100 feet) and permeable for re-injection of treated water. This treated water could, therefore, be successfully reinjected into the overburden near the center of the site and be recaptured by the aquifer from which it originated. Furthermore, the PDI had also re-examined the installation of a pipeline to the Higgins Farm treatment plant (Alternative 3B) and determined that the pipeline route would present many more difficulties, which were not assessed during the FS, in obtaining permits, rights-of-way, and easements from off-site areas, including the crossing of Dirty Brook. In addition to the new information in the PDI, a natural attenuation study was conducted to determine whether groundwater conditions were suitable for biodegradation processes. The analytical results provided several lines of evidence that biodegradation for select VOCs may be occurring.

As part of the FFS, a comparative analysis was conducted of the remedial alternatives. The results of this analysis indicated that both Alternative 3B and Alternative 4B would provide compliance with the identified applicable or relevant and appropriate requirements (ARARs), achieve the overall protection of human health and the environment, and reduce the toxicity, mobility, and volume of the site-related contaminants. However, the analysis also indicated that the potential for off-site

discharge of contaminated groundwater from a pipeline failure associated with Alternative 3B could affect its long-term effectiveness compared to the on-site treatment of Alternative 4B. In addition, the implementation of Alternative 3B would provide administrative uncertainties because of the requirements necessary for installing a pipeline off-site, such as obtaining easements and land owner access agreements, compared to the on-site remedial activities for Alternative 4B. Finally, after the remedial design activities have been completed, Alternative 4B could be implemented within 6 months compared to 18 months for Alternative 3B.

For Alternative 4B, the capital costs are estimated to be $729,350. Annual operation and maintenance is estimated to be $390,000. The present worth cost is estimated to be $2,700,000.

For Alternative 3B, the capital costs are estimated to be $2,464,710. Annual operation and maintenance is estimated to be $338,000. The present worth cost estimated to be $4,300,000.

Based on an evaluation of the two alternatives, EPA recommends Alternative 4B, instead of Alternative 3B, as the preferred groundwater remedy for the site. Alternative 4B includes the installation of extraction wells, on-site treatment from a WWTP, and reinjection of treated water into the aquifer. The extracted water will be piped to an on-site WWTP which includes flocculation, clarification, filtration followed by two granular-activated carbon (GAC) vessels, and final pH adjustment. As part of this groundwater remedy, a Classification Exemption Area (CEA) would need to be implemented for the impacted groundwater at the site until the contaminant concentrations meet federal and state maximum contaminant levels (MCLs) and New Jersey Groundwater Quality Standards Criteria. Alternative 4B would require operation and maintenance which consists of performance monitoring of the system and groundwater to ensure achievement of remediation goals.

The preferred alternative (Alternative 4B) is expected to cost approximately $1,600,000 less and provide the same level of protectiveness in significantly less time than the preferred remedy in the September 1997 ROD (Alternative 3B). In addition, the on-site treatment plant is more feasible to implement, and more cost-effective than the extension of an off-site pipeline.

SUPPORT AGENCY COMMENTS

NJDEP concurs with EPA on this modified remedy.

AFFIRMATION OF STATUTORY DETERMINATIONS

EPA and NJDEP believe that the modified remedy remains protective with respect to human health and the environment, complies with federal and state requirements that were identified in the ROD and this ESD as applicable or relevant and appropriate to this remedial action, and is cost effective. In addition, the remedy continues to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

PUBLIC PARTICIPATION

In accordance with the NCP, a formal public comment period is not required when issuing an ESD. However, since the community had expressed an interest in the 1997 ROD preferred remedy, EPA will announce the availability of this ESD and provide a public availability session.

Copies of the FFS, ESD and any other supporting documentation are available in the Administrative Record for this site maintained at the Mary Jacobs Memorial Library, Franklin Township Public Library and the U.S.Environmental Protection Agency (as described on Page 2).

Jane M. Kenny
Regional Administrator

12/9/02
Date

Attachment 3

STATEMENT OF WORK
Higgins Disposal Superfund Site
Town of Kingston, Somerset County, New Jersey

I. WORK TO BE PERFORMED

The objectives of the work (hereinafter "Work," as defined in the Unilateral Administrative Order, (Order), U.S. EPA Index No. CERCLA-02-2003-2034 (In the Matter of the Higgins Disposal Site) to which this Statement of Work is attached) to be conducted at the Higgins Disposal Superfund Site (Site) entails the implementation of the remedy selected in the Environmental Protection Agency's (EPA's) December 9, 2002 Explanation of Significant Difference (ESD) for the Site, attached as Appendix 2 to the Order. The major components of the remedy are to:

- Restore ground water to levels which meet the most stringent of the federal and state of New Jersey Maximum Contaminant Levels (MCLs) and New Jersey Ground Water Quality Standards (NJGWQS);
- Control the off-site migration of contaminated groundwater; and
- Conduct appropriate environmental monitoring to ensure the effectiveness of the remedy.

Additional elements of the remedy include:

☐ Treatment of the extracted ground water utilizing flocculation, clarification, filtration, granular activated carbon (GAC) units and final pH adjustment.

☐ Reinjection of the treated effluent into the overburden water bearing zone.

☐ Perform ground water sampling of on-site monitoring wells, sentinel wells and residential wells to ensure that the contamination concentrations are being reduced on-site and that the direction and magnitude of migrating contaminants do not result in exceedance of state and federal drinking water standards for individual supply wells.

☐ Establish a classification exemption area (CEA) for impacted ground water until constituent concentrations in ground water meet the NJGWQS.

The Work to be performed under the Order shall include, but shall not be limited to, the following:

A. Remedial Design (RD) of the Remedial Action;

B. Implementation of the Remedial Action (RA); and

C. Operation and Maintenance (O&M) and long term monitoring related to the Work.

II. PERFORMANCE STANDARDS

Performance Standards are the cleanup standards and other measures to achieve the goals of the Remedial Action.

The remedy shall comply with all Applicable or Relevant and Appropriate Requirements (ARARs) as set forth herein and the ESD, including, but not limited to, federal and State of New Jersey MCLs and New Jersey Ground Water Quality Standards. Accordingly, the remedy will eliminate and reduce the risk to human health and the environment at the Site.

III. PROJECT SUPERVISION/MANAGEMENT

All of the Work to be performed by Respondent pursuant to this Order shall be under the direction and supervision of a qualified New Jersey licensed engineer, hereinafter "project manager," the selection of which shall be subject to approval by EPA. Within fourteen (14) days after the effective date of this Order, Respondent shall submit to EPA and the New Jersey Department of Environmental Protection (NJDEP) in writing the name(s), title(s) and qualifications of the project manager, including primary support entities and staff, proposed for carrying out the work under this Order. With respect to any proposed project manager, Respondent shall demonstrate that the proposed project manager has a quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995), by submitting a copy of the proposed project manager's Quality Management Plan (QMP). The QMP should be prepared in accordance with the specifications set forth in "EPA Requirements for Quality Management Plans (QA/R-2," (EPA/240/B-10/002, March 2001) or equivalent documentation as determined by EPA. If at any time Respondent proposes to use a different project manager, Respondent shall notify EPA and shall obtain approval from EPA before the new project manager performs any work under this Order.

EPA will review Respondent's selection of a project manager according to the terms of this paragraph and Section XIV of this Order. If EPA disapproves of the selection of the project manager, Respondent shall submit to EPA within fourteen (14) days after receipt of EPA's disapproval of the project manager previously selected, a list of project managers, including primary support entities and staff, proposed for carrying out the work under this Order. EPA will thereafter provide written notice to Respondent of the names of the project managers that are acceptable to EPA. Respondent may then select any approved project manager from that list and shall notify EPA of the name of the project manager selected within twenty-one (21) days of EPA's designation of approved project managers.

IV. PRE-REMEDIAL DESIGN ACTIVITIES

The pre-RD activities to be performed in the implementation of the selected remedy for the Site include, but are not limited to, collecting groundwater samples and performing a hydrogeologic investigation, as deemed necessary by EPA, to optimize the placement of groundwater extraction wells.

V. REMEDIAL DESIGN ACTIVITIES

Respondent shall perform the Remedial Design as specified herein and in the ESD. The RD activities to be performed in the implementation of the remedy for the Site include, but are not limited to, the following:

A. Design of a ground water extraction/treatment system as outlined in the ESD. This design shall include, at a minimum, a determination of the number, depth, pumping rates, and location of the extraction wells.

B. Design of a plan to provide for long-term ground water quality monitoring to evaluate the effectiveness of the remedial action.

C. Development of a plan for the performance of air monitoring during construction activities at the Site to ensure that air emissions resulting from construction activities meet applicable or relevant and appropriate air emission requirements.

D. Preparation of a plan for establishing institutional controls (e.g., CEA) designed to prevent direct contact with contaminated ground water and prohibit the installation and use of ground water wells at the Site until ground water cleanup standards are achieved.

VI. REMEDIAL DESIGN WORK PLAN

Within thirty (30) days of the date on which Respondent receives written notification from EPA of the approval of the project manager, Respondent shall submit a detailed Remedial Design Work Plan for the design of the selected remedy to EPA for review and approval.

The Work Plan shall comply with CERCLA and relevant EPA guidance, including the EPA document entitled *Guidance on Oversight of Remedial Designs and Remedial Actions performed by Potentially Responsible Parties*, (OSWER directive 9355.5-01, EPA/540/g-90-001), dated April 1990 and shall be in conformance with, *inter alia,* the *Superfund Remedial Design and Remedial Action Guidance*, OSWER Directive 9355.0-4A, and other EPA guidance documents.

The Remedial Design Work Plan shall include plans and schedules for implementation of pre-RD and RD tasks, and shall include, but not be limited to, the following items as appropriate, the Quality Assurance Project Plan and a Health and Safety Contingency Plan, which shall comply with the following requirements:

A. Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) shall be prepared consistent with EPA *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, (EPA QA/R-5, March 2001), and shall include the following elements:

1. A detailed description of the sampling, analysis, and monitoring that shall be performed during the RD phase, consistent with this SOW, the ESD, and the Order. At a minimum, the QAPP shall provide the following:

   a. A plan for the performance of air monitoring, including air monitoring prior to and during construction at the Site, as necessary, to ensure that any air emissions resulting from the installation of the groundwater treatment system meets applicable or relevant and appropriate air emission requirements; and

   b. A plan for defining the specific limits of the groundwater contamination.

2. All sampling, analysis, data assessment, and monitoring shall be performed in accordance with the *EPA Region II's Quality Assurance Homepage*, http: //www.epa.gov/region02/desa/hsw/sops.htm, or an alternate EPA-approved test method, and the guidelines set forth in the Order. All testing methods and procedures shall be fully documented and referenced to established methods or standards.

3. The QAPP shall also specifically include the following items:

   a. An explanation of the way(s) the sampling, analysis, and monitoring will produce data for the RD phase;

   b. A detailed description of the sampling, analysis, and testing to be performed, including sampling methods, analytical and testing methods, sampling locations and frequency of sampling;

   c. A map depicting sampling locations; and

   d. A schedule for performance of specific tasks.

4. In the event that additional sampling locations and analyses are utilized or required, Respondent shall submit to EPA an addendum to the QAPP for approval by EPA.

5. The QAPP shall address the following elements:

   Project Management

   a. Title and Approval Sheet
   b. Table of Contents and Document Control Format
   c. Distribution List
   d. Project/Task Organization and Schedule

e. Problem Definition/Background
f. Project/Task Description
g. Quality Objectives and Criteria for Measurement Data
h. Special Training Requirements/Certification
i. Documentation and Records

Measurement/Data Acquisition

j. Sampling Process Design
k. Sampling Methods Requirements
l. Sample Handling and Custody Requirements
m. Analytical Methods Requirements
n. Quality Control Requirements
o. Instrument/Equipment Testing, Inspection, and Maintenance Requirements
p. Instrument Calibration and Frequency
q. Inspection/Acceptance Requirements for Supplies and Consumables
r. Data Acquisition Requirements (Non-Direct Measurements)
s. Data Management

Assessment/Oversight

t. Assessments and Response Actions
u. Reports to Management

Data Validation and Usability

v. Data Review, Validation, and Verification Requirements
w. Validation and Verification Methods
x. Reconciliation with Data Quality Objectives

6. In order to provide quality assurance and maintain quality control with respect to all samples to be collected, Respondent shall insure the following

a. Quality assurance and chain-of-custody procedures shall be performed in accordance with *EPA Region II's Quality Assurance Homepage*, http://www.epa.gov/region02/desa/hsw/sops.htm, and the guidelines set forth in this Order.

b. The laboratory to be used must be specified. If the laboratory participates in the Contract Laboratory Program (CLP) for the analysis to be performed for this investigation, then project specific Performance Evaluation (PE) samples will not be required, as CLP laboratories run EPA PEs on a quarterly basis. If the proposed laboratory does not participate in the CLP for the analyses required,

PE samples must be analyzed to demonstrate the capability to conduct the required analysis prior to being approved for use. Once a non-CLP laboratory has been selected, the laboratory should submit a copy of their Laboratory Quality Assurance Program Plan to EPA for review and approval.

For any analytical work performed at a non-CLP laboratory, including that done in a fixed laboratory, in a mobile laboratory, or in on-site screening analyses, Respondant must submit to EPA a "Non-CLP Superfund Analytical Services Tracking System" form for each laboratory utilized during a sampling event, within thirty (30) days after acceptance of the analytical results. Upon completion, such documents shall be submitted to the EPA Project Coordinator, with a copy of the form and transmittal letter to:

Regional Sample Control Center Coordinator
EPA Region 2
Division of Environmental Science & Assessment
2890 Woodbridge Avenue, Bldg. 209, MS-215
Edison, NJ 08837

c The laboratory utilized for analyses of samples must perform all analyses according to accepted EPA methods as documented in the *Contract Lab Program Statement of Work for Organic Analysis*, (OLM04.2) or the latest revision, and the *Contract Lab Program Statement of Work for Inorganic Analysis*, (ILM04.0) or the latest revision, or other EPA-approved test methods.

d. Unless indicated otherwise in the approved QAPP, all data will be validated upon receipt from the laboratory.

e. Submission of the validation package (checklist, report, and Form I containing the final data) to EPA, prepared in accordance with the provisions of Subparagraph g., below.

f. Assurance that all analytical data that are validated as required by the QAPP are validated according to the procedures stated in the *EPA Region II Contract Lab Program Organics Data Review and Preliminary Review* (SOP #HW-6, Revision 11), dated June 1996, or the latest revision, and the *Evaluation of Metals Data for the Contract Laboratory Program* (SOP #HW-2, Revision 11), dated January 1992 or the latest revision, or EPA-approved equivalent procedures. Region 2 Standard Operating Procedures are available at: http://www.epa.gov/region02/smb/sops.htm

g. Unless indicated otherwise in the approved QAPP, Respondant shall require deliverables equivalent to CLP data packages from the laboratory for analytical data. Upon the EPA's request, Respondant shall submit to the EPA the full documentation (including raw data) for this analytical data. EPA reserves the right to perform an independent data validation, data validation check, or qualification check on generated data.

h. Respondant shall insert a provision in its contract(s) with the laboratory utilized for analyses of samples, which will require granting access to EPA personnel and authorized representatives of the EPA for the purpose of ensuring the accuracy of laboratory results related to the Site.

B. Health and Safety Contingency Plan

A Health and Safety Contingency Plan (HSCP) for all activities, except the pre-RD sampling activities, performed under the Order shall be developed by Respondent to address the protection of public health and safety and the response to contingencies that could impact public health, safety, and the environment. The HSCP shall satisfy the requirements of the *Occupational Safety and Health Guidance for Hazardous Waste Site Activities*, (June 1990, DHHS NIOSH Publication No. 90-117), and the Occupational Safety and Health Administration, U.S. Department of Labor (OSHA) requirements cited below:

1. All site activities shall be performed in such a manner as to ensure the safety and health of personnel so engaged. All Site activities shall be conducted in accordance with all pertinent general industry (29 CFR Part 1910) and construction (29 CFR Part 1926) OSHA standards, and EPA's *Standards Operating Safety Guides* (OSWER, 1988), as well as any other applicable State and municipal codes or ordinances. All Site activities shall comply with those requirements set forth in OSHA's final rule entitled *Hazardous Waste Operations and Emergency Response*, 29 CFR §1910.120, Subpart H.

2. The HSCP shall include, at a minimum, the following items:

   a. Plans showing the location and layout of any temporary facilities to be constructed on or near the Site;

   b. Description of the known hazards and evaluation of the risks associated with the Site and the potential health impacts related to the Site activities;

   c. List of key personnel and alternates responsible for Site safety, response operations, and protection of the public;

d. Description of levels of protection (based on specified standards) to be utilized by all personnel;

e. Delineation of Work, decontamination, and safe zones, and definitions of the movement of zones;

f. Description of decontamination procedures for personnel and equipment, and handling and removal of disposable clothing or equipment;

g. Incidental emergency procedures which address emergency care for personnel injuries and exposure problems, and containment measures. These procedures shall include evacuation routes, internal and external communications procedures for response to fire, explosion, or other emergencies, the name of the nearest hospital and the route to that hospital. Local agencies with the capability to respond to emergencies shall be identified and their capabilities shall be described. A description of the procedures for informing the community of these measures shall be outlined;

h. Description of the personnel medical surveillance program in effect;

i. Description of monitoring for personnel safety;

j. Description of routine and special personnel training programs; and

k. Description of an air monitoring program to determine concentrations of airborne contaminants to which workers on-Site and persons near the Site boundary may be exposed. The results of work-zone air monitoring may be used as a trigger for implementing Site-boundary air monitoring.

C. Description of Pre-Remedial Design and Remedial Design Tasks

The Remedial Design Work Plan shall include a detailed description of all other pre-RD and RD tasks (see Sections IV and V above) to be performed, along with a schedule for performance of those tasks. Such tasks shall include, at a minimum, the preparation of the RD Reports required by Section VIII., below, and tasks necessary to ensure compliance with ARARs, as outlined herein and in the ESD. The Remedial Design Work Plan shall include an outline of the requirements of the RD Reports.

1. Access and Other Approvals

The Remedial Design Work Plan shall include descriptions of any approvals and institutional controls which Respondent will need to comply with the Order, with the exception of those approvals needed from the EPA. This

description shall detail how such approvals will be sought, and shall include a schedule for obtaining all necessary approvals. Such approvals shall include the consent of owners of property at or near the Site regarding access to conduct sampling, monitoring or other activities, in accordance with the Order, and approval from any off-Site facility accepting waste materials from the Site. This description shall be amended if subsequent approvals are required.

2. RD Schedules, Draft Schedule for Remedial Action, O&M, and Monitoring

The Remedial Design Work Plan shall include a schedule covering all pre-RD and RD activities, including but not limited to, the submittal of RD Reports listed in Section VIII., below. The Remedial Design Work Plan shall also include a draft schedule for remedial action (RA), O&M, and monitoring activities. The schedule shall be in the form of a task/subtask activity bar chart or critical path method sequence of events. The schedules are dependent on EPA approval of project documents.

3. The draft schedule for RA and monitoring activities may be revised during the remedial process, subject to the EPA's approval (see Sections VIII. A. 4. below).

4. The RD schedule shall provide for the completion and submittal to EPA of the Final Design Report within six (6) months of EPA's written notification of approval of the Remedial Design Work Plan.

5. The draft schedule for the RA shall provide for the completion of the construction of the Remedial Action within six (6) months of EPA's approval of the RA Work Plan (RAWP).

VII. APPROVAL OF REMEDIAL DESIGN WORK PLAN

EPA will either approve the Remedial Design Work Plan, or will require modification of such plan, in accordance with the procedures set forth in the Order. Upon approval by EPA, the Remedial Design Work Plan is incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order.

Respondent shall implement the EPA-approved Remedial Design Work Plan in accordance with the schedules contained therein. Any violation of the approved Remedial Design Work Plan shall be a violation of this Order. Unless otherwise directed by EPA, Respondent shall not perform further Work at the Site prior to EPA's written approval of the Remedial Design Work Plan.

VIII. REMEDIAL DESIGN

Respondent shall perform the pre-RD and RD activities in conformance with the Remedial Design Work Plan approved by the EPA and within the time frames specified in the RD schedule contained therein. The RD shall include the preparation of a Pre-Final RD Report (95% completion), and a Final RD Report (100% completion).

A. Pre-Final and Final RD Reports

The reports shall be submitted to the EPA and NJDEP in accordance with the schedule set forth in the approved Remedial Design Work Plan. Each RD report shall include a discussion of the design criteria and objectives, with emphasis on the capacity and ability to meet design objectives successfully. Each report shall also include the plans and specifications that have been developed at that point in time, along with a design analysis. The design analysis shall provide the rationale for the plans and specifications, including results of all sampling and testing performed, supporting calculations and documentation of how these plans and specifications will meet the requirements of the ESD and shall provide a discussion of any impacts these findings may have on the RD. The design report shall also include the following items (to the extent that work has been performed regarding the items), as appropriate:

1. A technical specification for photographic documentation of the remedial construction work;

2. A discussion of the manner in which the RA will achieve the Performance Standards;

3. A plan for establishing a CEA designed to prevent direct contact with contaminated ground water and control groundwater well use until the drinking water standards are achieved; and

4. A draft schedule for remedial action activities, and a preliminary schedule for monitoring activities.

B. Additional Pre-Final/Final RD Report Requirements

The pre-final and final RD reports shall include final plans and specifications, and, as appropriate:

1. A discussion of the manner in which the pre-design components detailed in Section IV., above, for the Remedial Action will be considered;

2. Piping & instrumentation diagrams, as necessary, showing all equipment and control systems;

3. Table of Contents for the specifications, including a listing of items from the Construction Specifications Institute master format that are expected to be included in the construction specifications. This master format is presented in the Construction Specifications Institute's *Manual of Practice*, 1985 edition, available from the Construction Specifications Institute, 601 Madison Street, Alexandria, Virginia 22314;

4. Engineering plans representing an accurate identification of existing Site conditions and an illustration of the work proposed. Typical items to be provided on such drawings include, at a minimum, the following:

   a. Title sheet including at least the title of the project, a key map, the name of the designer, date prepared, sheet index, and EPA/NJDEP Project identification;

   b. All property data including owners of record for all properties within 200 feet of the Site;

   c. A Site survey including the distance and bearing of all property lines that identify and define the project Site;

   d. All easements, rights-of-way, and reservations;

   e. All buildings, structures, wells, facilities, and equipment (existing and proposed) if any;

   f. A topographic survey, including existing and proposed contours and spot elevations for all areas that will be affected by the remedial activities, based on U.S. Coast and Geodetic Survey data;

   g. All utilities, existing and proposed;

   h. Location and identification of all significant natural features including, *inter alia*, wooded areas, water courses, wetlands, flood hazard areas, and depressions;

   i. Flood hazard data and 100-year and 500-year flood plain delineation;

   j. North arrow, scale, sheet numbers and the person responsible for preparing each sheet;

   k. Decontamination areas, staging areas, borrow areas and stockpiling areas;

   l. Miscellaneous detail sheets;

m. Definitions of all symbols and abbreviations; and

n. A specification for a sign at the site. The sign should describe the project, the name of the contractor performing the RD/RA work or the Respondent, and state that the project is being performed under EPA oversight, and provide an EPA contact for further information.

5. Survey work that is appropriately marked, recorded and interpreted for mapping, property easements and design completion;

6. Drawings of all proposed equipment, improvements, details and all other construction and installation items to be developed in accordance with all applicable current standards and guidelines. Drawings shall be of standard size, approximately 24" x 36". A list of drawing sheet titles will be provided;

7. Engineering plans (as necessary) indicating, at a minimum, the following:

a. Site security measures;

b. Roadways; and

c. Electrical, mechanical, structural, and HVAC drawings, if required.

8. Any value engineering proposals.

9. An RA O&M Plan. The RA O&M Plan shall be prepared in accordance with the *Superfund Remedial Design and Remedial Action Guidance*, OSWER Directive 9355.0-4A. The RA O&M Plan shall include, but not be limited to, the following:

a. a description of the personnel requirements, responsibilities, and duties, including a discussion for training, lines of authority;

b. a description of all construction-related sampling, analysis, and monitoring to be conducted under the Order; and

c. a description of all RA-related monitoring requirements associated with the groundwater treatment system.

10. A Construction Quality Assurance Project Plan (CQAPP), which shall detail the approach to quality assurance during construction activities at the Site, shall specify a quality assurance official (QA Official), independent of the project manager, to conduct a quality assurance program during the construction phase of the project. The CQAPP shall address sampling, analysis, and monitoring to be performed during the remedial construction phase of the Work. Quality assurance items to be addressed include, at a

minimum, the following:

a. Inspection and certification of the Work;

b. Measurement and daily logging;

c. Field performance and testing;

d. As-built drawings and logs;

e. Testing of the Work to establish whether the design specifications are attained; and

f. Testing methods appropriate to remedial construction including, at a minimum, testing of remedial construction materials, as necessary, prior to use, and testing of constructed remedial components to ensure that they meet design specifications.

11. A report describing those efforts made to secure access and institutional controls and obtain other approvals and the results of those efforts (see Section VI. C., above). Legal descriptions of property or easements to be acquired shall be provided.

12. A final engineer's construction cost estimate, which may be provided under separate cover concurrent with submittal of the Final RD Report.

13. A plan for implementation of construction and construction oversight.

14. A proposed schedule for implementing all of the above.

IX. APPROVAL OF RD REPORTS

A. EPA will review and comment on each of the RD Reports. Respondent shall make those changes required by the EPA's comments/modifications in accordance with the procedures set forth in the Order.

B. Changes required by EPA's comments on the Pre-Final RD Report (95% completion) shall be made in the Final RD Report (100% completion).

C. EPA will either approve the Final RD Report (100% completion) or require modifications, in accordance with the procedures set forth in the Order.

D. Upon EPA approval, the Final RD Report is incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order.

X. REMEDIAL ACTION

A. Within twenty-one (21) days after the approval of the Final RD Report (100% completion) by EPA, Respondent shall notify EPA in writing of the name, title, and qualifications of any construction contractor proposed to be used in carrying out work under this Order. With respect to any proposed construction contractor, Respondent shall demonstrate that the proposed construction contractor has a quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (American National Standard, January 5, 1995), by submitting a copy of the proposed project manages's QMP. The QMP should be prepared in accordance with the specifications set forth in "EPA Requirements for Quality Management Plans (QA/R-2)," (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. EPA shall thereafter provide written notice of the name(s) of the contractor(s) it approves, if any. Respondent may select any approved contractor from that list and shall notify EPA of the name of the contractor selected within twenty one (21) days of EPA's designation of approved contractors. If at any time Respondent proposes to change the construction contractor, Respondent shall notify EPA and shall obtain approval from EPA as provided in this paragraph, before the new construction contractor performs any work under this Order. If EPA disapproves of the selection of any contractor as the construction contractor, Respondent shall submit a list of contractors that would be acceptable to them to EPA within thirty (30) days after receipt of EPA's disapproval of the contractor previously selected.

B. Within thirty (30) days of the award of the RA contract, Respondent shall submit an Remedial Action Work Plan (RAWP) for remedial construction activities. The RAWP shall include, at a minimum, the following items:

1. If applicable, a "Request for Modification of Approved Final RD Report," including any requests for modification of the approved Final RD Report, based on construction methods identified by the contractor(s), or proposed modification of the construction schedule developed under Section VIII., above, or any other requests for modification, subject to EPA approval in its sole discretion.

2. A Site Management Plan (SMP) for RA activities. The SMP for RA shall include, at a minimum, the following items:

   a. Tentative identification of the RA Project Team (including, but not limited to the construction contractor).

   b. A final schedule for the completion of the RA and all major tasks therein, as well as a schedule for completion of required plans, and other deliverables (see Section VI. C., above).

c. Methodology for implementation of the Construction Quality Assurance Project Plan (developed during the RD).

d. Methodology for implementation of the RA O&M Plan.

e. Procedures and plans for the decontamination of construction equipment and the disposal of contaminated materials.

f. Methods for satisfying any permitting requirements.

g. Discussion of the methods by which construction operations shall proceed. Discussion shall include the following:

(1) Timing of and manner in which activities shall be sequenced;

(2) Preparation of the Site including security, utilities, decontamination facilities, construction trailers, and equipment storage;

(3) Coordination of construction activities;

(4) Site maintenance during the RA;

(5) Coordination with local authorities regarding contingency planning and potential traffic obstruction; and

(6) Entry and access to the Site during the construction period(s) and periods of inactivity, including provisions for decontamination, erosion control, and dust control.

h. Discussion of construction quality control, including:

A. Methods of performing the quality control inspections, including when inspections should be made and what to look for;

B. Control testing procedures for each specific test. This includes information which authenticates that personnel and laboratories performing the tests are qualified and the equipment and procedures to be used comply with applicable standards;

C. Procedures for scheduling and managing submittals, including those of subcontractors, off-Site fabricators, suppliers, and purchasing agents; and

D. Reporting procedures including frequency of reports and report formats.

3. A Quality Assurance/Quality Control Project Plan (QAPP) shall be prepared consistent with EPA *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, (EPA QA/R-5, March 2001) (see Section VI.A., above, for these requirements).

4. An updated HSCP for the Remedial Construction phase of the Work (see Section VI. B., above, for these requirements). The HSCP shall address health and safety measures to be implemented and observed by construction personnel, as well as recommended health and safety measures for the adjacent community and general public, together with a description of the program for informing the community of these recommendations. The HSCP shall include the name of the person responsible in the event of an emergency situation, as well as the necessary procedures that must be taken in the event of an emergency, as outlined in the Order.

C. Approval of Remedial Action Work Plan

EPA will either approve the RAWP or require modification of it in accordance with the procedures set forth in the Order. Upon approval by EPA, the RAWP is incorporated into this Order as a requirement of this Order and shall be an enforceable part of this Order.

D. Performance of Remedial Construction

1. Upon the EPA's written approval of the RAWP, Respondent shall initiate the remedial construction in accordance with the RAWP and the approved Final Design Report, which includes the approved remedial construction schedule.

2. During performance of the remedial construction, Respondent may identify and request EPA approval for field changes to the approved RAWP Final Design Report and construction schedule, as necessary, to complete the work. EPA will either approve, disapprove, or require modification of any requests for field changes in accordance with the procedures set forth in the Order.

E. Operation and Maintenance Manual

1. No later than thirty (30) days prior to the scheduled completion date of the remedial construction phase, Respondent shall submit to the EPA an O&M Manual. The O&M Manual shall conform to the EPA guidelines contained in *Considerations for Preparation of Operation and Maintenance Manuals*, EPA 68-01-0341.

2. The O&M Manual shall include, at a minimum, the following:

   a. An amended QAPP consistent with Section VI.A., above.

   b. An HSCP for O&M activities consistent with Section VI.B., above.

   c. A discussion of potential operating problems and remedies for such problems.

   d. A discussion of alternative procedures in the event of system failure.

   e. A schedule for equipment replacement.

   f. An O&M and monitoring schedule.

3. EPA will either approve the O&M Manual or require modification of it, in accordance with the procedures set forth in the Order.

4. Proposed modifications to the approved O&M Manuel may be submitted to EPA for consideration upon completion of construction or thereafter if Respondent can demonstrate that such modifications would enhance and/or maintain the environmental monitoring programs.

5. EPA will either approve, disapprove, or require modifications of the request for modification of the O&M Manual in accordance with the procedures set forth in the Order.

XI. PRE-FINAL AND FINAL INSPECTIONS, REMEDIAL ACTION REPORTS, NOTICE OF CONSTRUCTION COMPLETION

A. At least fourteen (14) days prior to the completion of construction, Respondent and their contractor(s) shall be available to accompany EPA personnel and/or their representatives on a pre-final inspection. Each pre-final inspection shall consist of a walkover of the Site to determine the completeness of the construction and its consistency with the RD Reports, the Order, the ESD and applicable federal and state laws, rules, and regulations.

B. Following each pre-final inspection, EPA will either specify the necessary corrective measures to the construction phase of the Remedial Action, as appropriate, or determine that construction is complete. If EPA requires corrective measures, Respondent shall undertake the corrective measures according to a schedule approved by EPA. Within fourteen (14) days after completion of the construction of the corrective measures, Respondent and their contractor(s) shall be available to accompany EPA personnel or their representatives on an inspection as provided for in the preceding paragraph. Said inspection will be followed by further directions and/or notifications by EPA as provided above in this paragraph.

C. Within twenty-one (21) days of the date that Respondent concludes that they have met the remedial action groundwater Performance Standards as specified in the ESD and this SOW, Respondent shall schedule and conduct a final inspection for Remedial Action to be attended by Respondent and EPA, NJDEP, and/or their respective its representatives. The final inspection will consist of a walk-through of the project to determine the completeness of the Remedial Action and its consistency with the ESD, this SOW, and the Order. EPA may direct Respondent to correct any deficiencies identified during the inspection. Respondent shall implement the tasks necessary to correct any deficiencies in accordance with the specifications and schedules established by EPA. Within fourteen (14) days of completion of the tasks, Respondent shall be available to accompany EPA and NJDEP personnel and/or their respective representatives on a follow-up inspection. If, after the final inspection for Remedial Action (or the follow-up inspection, if required), Respondent still believes that the remedial action Performance Standards have been attained, within thirty (30) days of the final inspection for Remedial Action (or the follow-up inspection, if required), Respondent shall submit a Draft Interim Remedial Action Report, as set forth in Subsection D., below.

D. The Draft Interim Remedial Action Report set forth in Subsection C., above, shall include the following sections:

1. Introduction

   a. Include a brief description of the location, size, environmental setting, and operational history of the site.

   b. Describe the operations and waste management practices that contributed to contamination of the site.

   c. Describe the regulatory and enforcement history of the site.

   d. Describe the major findings and results of site investigation activities.

   e. Briefly outline prior removal and remedial activities at the site.

2. Background

   a. Summarize requirements specified in the ESD. Include information on the cleanup goals, institutional controls, monitoring requirements, operation and maintenance requirements, and other parameters applicable to the design, construction, operation, and performance of the RA.

   b. Provide additional information regarding the basis for determining the cleanup goals, including planned future land use.

c. Summarize the RD, including any significant regulatory or technical considerations or events occurring during the preparation of the RD.

d. Identify and briefly discuss any and all ROD Amendments, ESDs or technical impracticability waivers.

3. Construction Activities

a. Provide a step-by-step summary description of the activities undertaken to construct and implement the RA (*e.g.*, mobilization and site preparatory work; construction of the treatment system; associated site work, such as fencing and surface water collection and control; system operation and monitoring; and sampling activities).

b. Refer the reader to the Appendices for characteristics, site conditions, and operating parameters for the system.

4. Chronology of Events

a. Provide a tabular summary that lists the major events for the Remedial Action and associated dates of those events, starting with ESD signature.

b. Include significant milestones and dates, such as, remedial design submittal and approval; mobilization and construction of the remedy; significant operational events such as treatment system, application start-up, monitoring and sampling events, system modifications, operational down time, variances or noncompliance situations, and final shutdown or cessation of operations; final sampling and confirmation-of-performance results; required inspections; demobilization; and completion or startup of post-construction operation & maintenance activities.

c. Indicate when cleanup goals are projected to be achieved for the ground water restoration.

5. Performance Standards and Construction Quality Control

a. Describe the overall performance of the technology in terms of comparison to cleanup goals.

b. For treatment remedies, identify the quantity of material treated, the strategy used for collecting and analyzing samples, and the overall results from the sampling and analysis effort.

c. Provide an explanation of the approved construction quality assurance and construction quality control requirements or cite the appropriate reference for this material. Explain any substantial problems or deviations.

d. Provide an assessment of the performance data quality, including the overall quality of the analytical data, with a brief discussion of QA/QC procedures followed, use of a QAPP, comparison of analytical data with data quality objectives.

6. Final Inspection and Certifications

a. Report the results of the various RA contract inspections, and identify noted deficiencies.

b. Briefly describe adherence to health and safety requirements while implementing the RA. Explain any substantial problems or deviations.

c. Summarize details of the institutional controls (*e.g.*, the type of institutional control, who will maintain the control, who will enforce the control).

d. Describe results of pre-certification inspection.

e. This section shall include a certification statement, signed by a responsible corporate official of one or more of the Respondent or by the Respondent project coordinator, which states the following:

"To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

7. Continued Operation and Maintenance Activities

a. Describe the general activities for post-construction operation and maintenance activities, such as monitoring, site maintenance, and closure activities.

b. Identify potential problems or concerns with such activities.

c. Describe the future ground water restoration activities to meet cleanup goals.

8. Summary of Project Costs

a. Provide the actual final costs for the project. If actual costs are not available, provide estimated costs.

b. Provide the costs previously estimated in the ESD for the selected remedy, including, as applicable, RA capital costs, RA operating costs, and number of years of operation. Adjust the estimates to the same dollar basis year as the actual project costs, and provide the index used.

c. Compare actual RA costs to the adjusted ESD estimates. If outside range of -30 to +50 present, explain the reason for the difference.

d. Refer the reader to the Appendix for a detailed breakdown of costs.

9. Observations and Lessons Learned

Provide site-specific observations and lessons learned from the project, highlighting successes and problems encountered and how they were resolved.

10. Contact Information

Provide contact information (names, addresses, phone numbers, and contract/reference data) for the major design and remediation contractors, as applicable.

11. Appendices: Cost and Performance Summary

a. The specific parameters for documenting cost and performance information are presented in the *Guide to Documenting and Managing Cost and Performance Information for Remediation Projects*, EPA 542-B-98-007.

b. Identify the matrix characteristics and site conditions that most affected the cost and performance, the corresponding values measured for each characteristic or condition, and the procedures used for measuring those characteristics or conditions.

c. Identify the operating parameters specified by the remediation contractor that most affected the cost and performance, the corresponding values measured for each parameter, and the procedures used for measuring those parameters. These items include system throughput, pumping rate, flow rate, mixing rates, residence time, operating pressure and temperature, moisture content, and pH.

d. Provide a detailed breakout of the actual RA capital costs, estimated RA operating costs (costs to operate and maintain the water treatment system).

e. Provide supplemental information in appendices to the Remedial Action Report. These could include a map of the site and operable unit, a schematic of the treatment system, supplemental performance information, and a list of references.

E. EPA will either approve the Draft Interim Remedial Action Report, thus making them the Final Remedial Action Report, require modifications of them, and/or require corrective measures to fully and properly implement the Remedial Action, in accordance with Subsections B. or C., above.

XII. PERFORMANCE OF CONTINUED OPERATION OF THE REMEDIAL ACTION

A. Upon EPA's approval of the Remedial Action Report for the Remedial Work (see Section XI. E., above), Respondent shall continue remedial action and monitoring activities in accordance with the approved O&M Manual.

B. Notice of Completion and Final Remedial Action Report for Remedial Work

1. Within thirty (30) days of the date that Respondent concludes that they have met the Performance Standards as specified in the ESD and this SOW for the third consecutive year (or a shorter period if approved by EPA in its sole discretion), or, if alternative remedial strategies are authorized by EPA, within thirty (30) days of completion of those strategies, Respondent shall submit to EPA a Notice of Completion and a Final Remedial Action Report. The Final Remedial Action Report shall be in the format specified in section XI. D.

2. EPA will determine whether the RA (including any alternative remedial strategies) has been completed in accordance with the standards, specifications and reports required by the Order. If EPA determines that they have not been so completed, EPA will notify Respondent in writing of those tasks which must be performed to complete the RA (including any alternative remedial strategies). Respondent shall then implement the specified activities and tasks in accordance with the specifications and schedules established by EPA and shall then submit a further report on the specified activities and tasks and certification signed by a registered New Jersey professional engineer, within thirty (30) days after completion of the specified activities and tasks. Any modifications to the Final Report for the RA required by EPA shall be in accordance with the procedures set forth in the Order.

3. Upon EPA's certification of completion of the RA (including any alternative remedial strategies), Respondent shall perform post-remediation monitoring in accordance with the Post-Remediation Monitoring Plan, as set forth in Section XIII., below.

C. Goal for Aquifer Restoration

1. As set forth in the ESD, the Performance Standards for aquifer restoration at the Site are the federal and state of New Jersey MCLs, and the promulgated NJGWQS. Respondent shall continue the remedial action related to the ground water remediation system until the Performance Standards have not been exceeded for a period of three (3) consecutive years, or a shorter period if approved by EPA in its sole discretion.

2. Respondent may petition EPA in writing for authorization to amend the ground water O&M Manual if, based on the results of ground water monitoring, Respondent believe that some or all of the Performance Standards specified in the ESD will not be reached in the time period projected in the approved O&M Manual. Respondent shall not submit such a petition until they have performed O&M of the ground water remediation system for at least five (5) years from the date of EPA's approval of the Final Remedial Action Report, as set forth in Section XI. C. and E., above.

3. Respondent's petition for authorization to amend the ground water O&M Manual shall include, at a minimum, the following information, as well as any other information and analyses EPA requests prior to or following submission of the petition:

   a. a list identifying each Performance Standard that has not been met;

   b. a description of any changes in the conceptual model for Site contamination since issuance of the ESD, including geological, hydrogeologic, and geochemical characterizations;

   c. comprehensive groundwater monitoring data relevant to the groundwater remedy implemented;

   d. an analysis of the performance of the groundwater remedy which describes the spatial and temporal trends in groundwater contaminant concentrations within the groundwater plume (*e.g.*, whether contaminant migration has been effectively prevented (as well as any reduction or changes in the overall size or location of the groundwater plume), or stabilized (or very slow decreases in contaminant concentrations));

   e. a description of any proposed contingency measures; and

f. a predictive analysis of the approximate time frame required to achieve the Performance Standards with both the existing groundwater remediation system and that to be implemented with any proposed contingency measures using methods appropriate for the data and Site-specific conditions. Such analysis shall also address the uncertainty, if any, inherent in these predictions. The petition shall not be deemed complete until all information and analyses required and/or requested by EPA are submitted by the Respondent.

D. If, based on the results of ground water monitoring, EPA believes that one or more of the Performance Standards specified in the ESD will not be reached in the time period projected in the approved O&M Manual and Respondent have not petitioned EPA in writing for authorization to amend the O&M Manual, EPA may require Respondent to implement contingency measures and to submit a Contingency Measures Plan (see Section XII. E., below).

E. A Contingency Measures Plan shall be submitted to EPA by Respondent within thirty (30) days of receipt of EPA's written determination that contingency measures are appropriate. The Contingency Measures Plan shall:

1. address design, construction, and O&M of the Contingency Measures, as appropriate;

2. include an amended QAPP and HSCP for O&M activities, as appropriate; and

3. include a schedule for the implementation of the Contingency Measures.

F. EPA will either approve the Contingency Measures Plan or disapprove and/or require modification of such plan, in accordance with the procedures set forth in the Order.

G. Respondent shall commence with the implementation of the Contingency Measures Plan within thirty (30) days of receipt of EPA's written approval of the Contingency Measures Plan.

H. No action taken by EPA pursuant to this Section of the SOW, including EPA's decision on Respondent's petition(s), shall be subject to dispute resolution or judicial review.

XIII. POST REMEDIATION MONITORING PLAN

A. Within thirty (30) days of the date on which all designated ground water monitoring points have recorded readings less than or equal to the Performance Standards specified in the ESD and this SOW for the third consecutive year (or a shorter period

if approved by EPA in its sole discretion), or within sixty (60) days of the date that EPA determines, in its sole discretion, that one or more ARAR waivers are granted and all other ground water ARARs have been met and/or waived, Respondent shall submit to EPA a Post-Remediation Monitoring (PRM) Plan.

B. The PRM Plan shall include, at a minimum, the following:

1. A QAPP for PRM activities consistent with Section VI. A., above;

2. An HSCP for PRM activities consistent with Section VI. B., above;

3. A description of work to be performed under PRM activities; and

4. A PRM schedule that identifies the frequency of monitoring and when these activities will commence.

C. EPA will either approve the PRM Plan, or require modification of it, in accordance with the procedures set forth in this Order.

XIV. POST REMEDIATION MONITORING

A. Upon EPA's approval of the PRM Plan, Respondent shall commence with the PRM program for a period of five (5) years, in accordance with the PRM Plan, which includes the PRM schedule.

B. If ground water contaminant concentrations increase above the Performance Standards (as specified in the ESD and this SOW), during post-remediation monitoring, EPA will evaluate the need to reinstate the remediation system and may require Respondent to do so.

C. Notice of Completion and Final Report for Post-Remediation Monitoring

1. Within five (5) days of the completion of post-remediation monitoring, Respondent shall submit to EPA a Notice of Completion for Post-Remediation Monitoring. The Notice of Completion for Post-Remediation Monitoring shall be signed by a New Jersey registered professional engineer meeting any and all requirements of applicable Federal, State, and local laws, and shall certify that the PRM activities have been completed in full satisfaction of the requirements of the Order, this SOW, and all plans, specifications, schedules, reports and other items developed hereunder.

2. Within thirty (30) days of the completion of post-remediation monitoring, Respondent shall submit to EPA a Final Report for Post-Remediation Monitoring. The Final Report for Post-Remediation Monitoring shall

summarize the Work performed under the PRM Plan and the data so generated. Deliverables under the Final Report for Post-Remediation Monitoring shall be signed by a New Jersey registered professional engineer meeting any and all requirements of applicable Federal, State, and local laws, and shall certify that the PRM activities and report deliverables have been completed in full satisfaction of the requirements of the Order, this SOW, and all plans, specifications, schedules, reports and other items developed hereunder. Any modifications to the Final Report for Post-Remediation Monitoring required by EPA shall be in accordance with the procedures set forth in the Order.

3. EPA will determine whether the PRM activities or any portion(s) thereof have been completed in accordance with the standards, specifications, and reports required by this Order. If EPA determines that PRM activities have not been so completed, EPA will notify Respondent in writing of those tasks which must be performed to complete the post-remediation monitoring. Respondent shall then implement the specified activities and tasks in accordance with the specifications and schedules established by EPA and shall then submit a further report on the specified activities and tasks, certified by a New Jersey registered professional engineer, within thirty (30) days after completion of the specified activities and tasks. EPA will notify Respondent in writing when PRM activities have been completed in accordance with the requirements of the Order.

XV. INSTITUTIONAL CONTROLS

Institutional Controls shall be required to prohibit the installation and use of ground water wells at the Site for the purpose of drinking water until ground water cleanup standards are achieved. Respondent shall secure institutional controls in accordance with the procedures set forth in the Order. The restrictions shall be maintained until EPA notifies Respondent that EPA has determined, after a reasonable opportunity for review and comment by the State of New Jersey, that the restrictions may be lifted from the Site, or a portion of the Site, without posing a threat to human health and the environment.

XVI. CERTIFICATION OF COMPLETION OF THE WORK

Within ninety (90) days after Respondent conclude that all phases of the Work required by the Order have been fully performed, Respondent shall schedule and conduct a pre-certification inspection to be attended by Respondent and EPA. If, after the pre-certification inspection, Respondent believes that the Work has been fully performed, Respondent shall submit a written report by a New Jersey registered professional engineer stating that the Work has been completed in full satisfaction of the requirements of this Order. If, after review of the written report, EPA, after reasonable opportunity for review and comment by the State, determines that any portion of the Work has not been completed in accordance

with this Order, EPA will notify Respondent in writing of the activities that must be undertaken by Respondent pursuant to this Order to complete the Work.

If EPA concludes, based on the initial or any subsequent request for Certification of Completion by Respondent and after a reasonable opportunity for review and comment by the State, that the Work has been performed in accordance with this Order, EPA will so notify Respondent in writing.

EPA's notification shall not limit EPA's right to perform periodic reviews pursuant to section 121(c) of CERCLA, 42 U.S.C. 9621(c), or to take or require any action that in the judgment of EPA is appropriate at the Site, in accordance with 42 U.S.C. 9604, 9606, or 9607.